

WORK PLAN FOR MTBE INVESTIGATION

July 24, 1997

UNOCAL 76 (TOSCO) STATION 4357

11280 National Boulevard

Los Angeles, California

WORK PLAN FOR MTBE INVESTIGATION

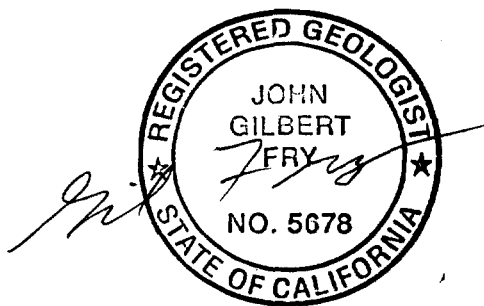
July 24, 1997

UNOCAL 76 (TOSCO) STATION 4357
11280 National Boulevard
Los Angeles, California

Prepared For:

Tosco Marketing Company
P.O. Box 25376
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Work Plan for MTBE Investigation
Unocal 76 (Tosco) Station 4357
July 24, 1997

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1.0 OBJECTIVE

This work plan responds to the request for the investigation of the potential presence of Methyl Tertiary Butyl Ether (MTBE) in the subsurface at Unocal 76 (Tosco) Station 4357, located at 11280 National Boulevard, Los Angeles, California (Figure 1).

2.0 SITE DESCRIPTION

Unocal Service Station 4357 is located on the southeast corner of National Boulevard and Sawtelle Boulevard (Figure 1). The site contains two 12,000-gallon underground gasoline storage tanks (USTs) northwest of the station building and one 550-gallon waste oil storage tank south of the station building. Gasoline is dispensed from four dispenser islands located north and west of the station building. A commercial retail center is located across National Boulevard to the northwest and additional commercial properties are located north, west, and south of the site. The San Diego Freeway is located east of the site.

3.0 CHRONOLOGY OF SITE ACTIVITIES

In September 1992, two 10,000-gallon gasoline USTs, one 10,000-gallon diesel UST, and one 550-gallon waste oil UST were excavated and removed from the site. The gasoline and waste oil USTs were subsequently replaced with two 12,000-gallon USTs and one 550-gallon UST, respectively. During the course of underground storage tank removal activities, soil samples were obtained from beneath the USTs, dispensers, and along product lines. Total gasoline-range petroleum hydrocarbons (TPH-G) concentrations in excess of 100 parts per million (ppm) were observed in soil samples obtained from beneath the southwestern and southeastern dispenser islands at depths of 2 feet below grade (fbg) and in the southeastern portion of the underground storage tank cavity at a depth of approximately 12 fbg (Montgomery Watson, 1992). Approximately 710 tons of potentially hydrocarbon affected soil was excavated and transported to the Puente Hills Landfill in Whittier, California for disposal. The vertical and lateral extent of adsorbed phase hydrocarbons was not characterized during tank, line, and dispenser replacement activities.

In March 1993, three hand auger soil borings (HB-2 through HB-4), three angle soil borings (SB-1 through SB-3), and four vertical soil borings (B-1 through B-4) were drilled to total depths ranging from 10 to 95 fbg. Soil Boring B-1 was subsequently converted to vapor monitoring well VE-1 and was completed to a total depth of approximately 90 fbg. Adsorbed phase hydrocarbons in excess of 100 ppm TPH-G were observed in soil Boring B-1 (VE-1) immediately south of the former underground storage tank location. No TPH-G concentrations in excess of 100 ppm were observed in any other soil samples obtained during site assessment activities (Montgomery Watson, 1993). The

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vertical and lateral extent of adsorbed phase hydrocarbons was adequately assessed by this investigation.

In September 1993, a soil venting test was conducted using existing vapor well VE-1 as a test well. During the test, the applied vacuum ranged to 48 inches of water column while extraction rates ranged to 155 cubic feet per minute (cfm) (VET, 1993). Analytical results of vapor samples obtained during the course of the vapor extraction testing indicated a maximum vapor phase hydrocarbon concentration of 783 parts per million by volume (ppmv). This relatively low hydrocarbon vapor concentration suggests that either the mass of hydrocarbons potentially present in the subsurface is small or that residual petroleum hydrocarbons are not readily extractable. In addition, field monitoring data indicate an initially low oxygen concentration in subsurface air and an increase in oxygen concentrations during the course of soil vent test. This finding suggests that intrinsic biodegradation of adsorbed phase hydrocarbon had been occurring in the subsurface.

A Formal Site Closure Request dated September 16, 1996 was submitted to the Los Angeles City Fire Department (LACFD). A "no further action" letter dated May 13, 1997 was received from the LACFD.

On July 1, 1997, Well VW-1 was gauged to assess the presence of groundwater within the well. No groundwater was encountered in the well and the total depth of the well was measured at 90.25 fbg.

On July 9, 1997, a vapor sample was collected from Well VW-1 using a mobile vapor extraction system with a SCAQMD Various Sites Location Permit. This sample was analyzed for TPH-G using EPA Method 8015 modified, BTEX using EPA Method 8020, and MTBE using EPA Method 8260. The results were: 67 ppmv TPH, 0.23 ppmv benzene, 5.5 ppmv toluene, 0.68 ppmv ethylbenzene, 7.4 ppmv total xylenes, and 0.84 ppmv MTBE.

4.0 GENERAL SITE CHARACTERISTICS

- In general, soil types encountered from grade to 12 to 20 fbg consisted of clay and is underlain by a clayey silt with a thickness of 5 to 10 feet (Montgomery Watson, 1993). A second clay layer was encountered between 20 and 30 fbg and varies in thickness between 3 and 10 feet. Interbeds of silty sand, clayey sand, sand, and clay were encountered to the total depth of investigation (95 fbg). Groundwater was not encountered during drilling activities to the maximum depth of investigation (95 fbg).
- The highest concentrations of TPH-G and benzene were observed in soil samples obtained from Boring B-1 (maximum TPH-G and benzene concentrations of 3,100 ppm and 0.9 ppm, respectively at depths of 20 and 40 fbg). No benzene concentrations in excess of 1 ppm were

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observed in any soil samples obtained during the course of UST, line, and dispenser removal activities or during the course of site assessment activities. The maximum concentration of benzene observed (1.0 ppm) was in soil sample P-4 obtained beneath the southwestern dispenser island at a depth of approximately 2 fbg. Benzene concentrations were either at or below laboratory detection limits in 52 of 61 total soil samples analyzed.

Refer to Appendices A and B for the results of previous site assessment activities.

5.0 PLANNED WORK

To further assess the lateral and vertical extent of MTBE-affected soil and possibly groundwater, Alton Geoscience proposes a phased approach.

5.1 PHASE I: SOIL INVESTIGATION

To assess the lateral and vertical extent of MTBE-affected soil in the vicinity of the former underground storage tanks, associated product piping, vent piping, and dispenser islands, and to delineate the extent of previously identified hydrocarbon-affected soil, Alton Geoscience will drill up to 17 borings. The locations of the proposed borings are shown on Figure 2. The rationale for the borings is provided below:

- Eight (8) hand-auger borings will be drilled in the vicinity of the dispenser islands to a depth of approximately 10 fbg. These borings will address the presence of hydrocarbons, if any, released from the dispenser islands and product lines.
- Two (2) hand-auger borings will be drilled in the vicinity of the vent lines to a depth of approximately 10 fbg. These boring will address the presence of hydrocarbons, if any, released from the vent lines.
- Five (5) primary hollow-stem auger borings will be drilled to assess the lateral and vertical extent of hydrocarbon-affected soil encountered during previous site assessment activities. The first boring will be drilled adjacent to Well VW-1 to assess the vertical extent of hydrocarbon-affected soil. The boring will be extended to the deepest depth of the two following scenarios: 1) to a depth of 25 feet below the deepest current hydrocarbon-affected soil as determined by an onsite mobile laboratory, or 2) to a depth of 115 fbg which is 25 feet below the deepest historic hydrocarbon-affected soil (0.019 ppm total xylenes in Well VW-1 at 90 fbg) encountered at the site. If groundwater is encountered prior to reaching the "25-foot depth" beneath hydrocarbon-affected soil, samples will be collected from the saturated zone for possible future well screening analysis. The remaining four borings will be drilled to assess the lateral extent of hydrocarbon-affected soil.

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Three of these borings will be drilled adjacent to the USTs and one will be drilled north of Well VW-1 (Figure 2).

- Two (2) contingency hollow-stem auger borings may be installed depending on the results of the laboratory analysis of the five primary borings. The locations of these borings are shown on Figure 2. The locations of these borings may be adjusted based on the results of the initial borings.

A hollow stem auger drilling rig will be used to advance the borings. General field procedures describing the drilling method, equipment, and procedures for completing soil borings, equipment and procedures for collecting and handling geologic materials for chemical and physical testing, and borehole backfill materials and procedures are included in Appendix C.

A minimum of three of the hollow-stem auger borings will have samples collected continuously during drilling. Soil samples will be collected using a 5-foot core barrel lined with 3-inch sampling rings. Soil samples for laboratory analysis will be collected at a minimum of 5-foot intervals and at each change in lithology or change in soil contamination as determined by an organic vapor analyzer. A sample will be collected from the middle of any low permeability or high moisture content unit if the unit is thicker than five feet.

Soil samples will be collected, described, and transported via chain of custody protocol as described in the general field procedures (Appendix C).

Boring logs will be prepared which will include the following:

- Description of earth materials, conditions, and classifications per the USCS
- Lithographic column with USCS abbreviations and symbols
- Sample depth in feet
- Penetration in blows per foot (blow counts) for pounded samples and inches (or percent) of sample recovered
- Vapor readings of samples using OVA

A representative number of soil samples shall be collected for physical testing at depths representative of the vadose zone, and aquifer and aquitard materials onsite. These data shall be used to guide the installation of groundwater monitoring wells, if necessary, and for site specific assessment, remediation, and transport modeling activities, if necessary. Soil chemical and physical data collected during site assessment and/or remediation phases to perform site specific risk assessment and/or fate and transport modeling will include the following:

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- Fraction of organic carbon content (foc)
- Grain-size distribution
- Effective soil porosity
- Bulk density
- Soil Moisture content
- Plasticity index for clayey and silty materials (Atterberg limits)
- Gas permeability (if possible)
- Vertical permeability

Selected exploratory test borings may be logged using downhole geophysical methods. The following suite or a portion of the following suite may be used: EM induction Log, Natural Gamma Log, Density Log, and Neutron Log.

5.2 PHASE II: GROUNDWATER INVESTIGATION

If hydrocarbons are detected in soil samples within 25 feet of groundwater, a groundwater investigation will be conducted. The objective of the groundwater investigation will be to investigate: 1) the potential impacts of discharges to groundwater quality, 2) the lateral and vertical extent of the plume, if present, 3) the groundwater gradient and flow direction, 4) specific aquifer properties if necessary, 5) the depth of any impacted aquifers, including groundwater production zones, and 6) preferential pathways which could allow transport of hydrocarbons to drinking water aquifers. This will include an investigation of any improperly constructed or abandoned wells, discontinuous aquifers, faults acting as boundaries to or conduits for flow, subsurface utilities, excavations which cut through aquitards or require dewatering, and baseline water quality of the aquifers monitored for the site investigation.

To investigate the uppermost aquifer, Alton Geoscience will install three groundwater monitoring wells into the uppermost aquifer, one up gradient and two downgradient of the potential source area (see Figure 2). Information obtained from the continuously cored soil test borings in Phase I will be used to define local stratigraphy and to obtain site specific data for designing initial groundwater monitoring wells. During drilling activities, no competent clay layer below the saturated zone will be penetrated. Physical and hydraulic tests will be conducted of any confining zone materials to determine competency. A sample of the confining materials, if present, will be collected from the end of the borehole for chemical and physical analysis.

The aquifer materials will be characterized based on sieve analysis for proper selection of the filter pack and screen. The well will be designed such that less than 10% of the filter pack should enter the well.

Selected monitoring wells installed at the site will be geophysically logged by qualified personnel to confirm the geologic logging per USCS during drilling of the well.

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General field procedures for well construction are included in Appendix C. At a minimum, 4-inch-diameter schedule 40 PVC well casing material will be used. The casing materials will be suspended and centralized such that they are not resting against the side or bottom of the hole prior to fixing in place. Selected filter pack material will be placed from the total depth of the boring to approximately 2 feet above the screened interval. A three-foot bentonite seal will be placed above the filter pack material. Grout of cement, bentonite or mixture will be placed in the remainder of the borehole in an appropriate manner to avoid bridging.

The wells will be professionally surveyed to a local benchmark, if available. All data points will be surveyed relative to the California State Plane Coordinate System. Coordinates will be given for all data points in reporting documents.

Well seal materials will be allowed to set for at least 48 hours prior to well development. Wells will be developed such that water samples will be representative of the formation water. Water samples will be collected a minimum of three days after well development. An attempt will be made to collect water samples with less than 5 NTUs of turbidity measurement. General field procedures for groundwater sampling are included in Appendix C.

If and when any municipal supply wells operated by the City of Santa Monica and/or the Southern California Water Company are turned on within the Charnock Sub-Basin Investigation Area, the site groundwater monitoring wells installed into the Ballona Aquifer and/or the Silverado (or equivalent) Aquifer, will be monitored for possible influence due to drawdown and/or recovery. Quarterly groundwater monitoring will be conducted for a minimum of one year .

A map will be provided showing the locations of the proposed wells and any existing groundwater monitoring wells or drinking water supply wells within 1,000 feet of the site.

Well design criteria, specifications, and construction details including casing and screen materials, screen length and placement with respect to the water table, depth and type of annular seal; proposed drilling methods and decontamination procedures will be provided following evaluation of the data obtained during Phase I of this operation.

5.3 LABORATORY ANALYSIS

Soil and water samples will be handled and analyzed as required in Appendix C-3 of the correspondence from the United States Environmental Protection Agency and the Los Angeles Regional Water Quality Control Board dated June 19, 1997.

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5.4 WASTE DISPOSAL

Soil and auger rinsate generated during drilling activities will be stored onsite in Department of Transportation (DOT)-approved roll-off bins and/or 55-gallon drums pending offsite disposal or recycling. Waste manifests will be prepared for proper transport and disposal.

5.5 REPORT

A report of field activities will be prepared for submittal. The report will incorporate all boring logs, geophysical logs, and sieve analysis results with interpretation. If present, the groundwater plumes for TPHg, BTEX, and MTBE will be illustrated by plan view and cross section to scale and will include direction of section lines, scale, legend, constituent concentrations, and lithology.

6.0 WORK SCHEDULE

Planned activities will be performed according to the following schedule:

- Initiate field work within three weeks of receiving work plan approval from the California Regional Water Quality Control Board.
- Submit supplemental site assessment report within eight weeks of completing field work.

7.0 SITE SAFETY PLAN

A site health and safety plan designed to promote project personnel safety and preparedness during the activities described in this proposal is included in Appendix D.

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July 24, 1997

8.0 REFERENCES

Alton Geoscience, 1996. Formal Site Closure Request. Unocal Service Station #4357, 11280 National Boulevard, Los Angeles, California. September 16.

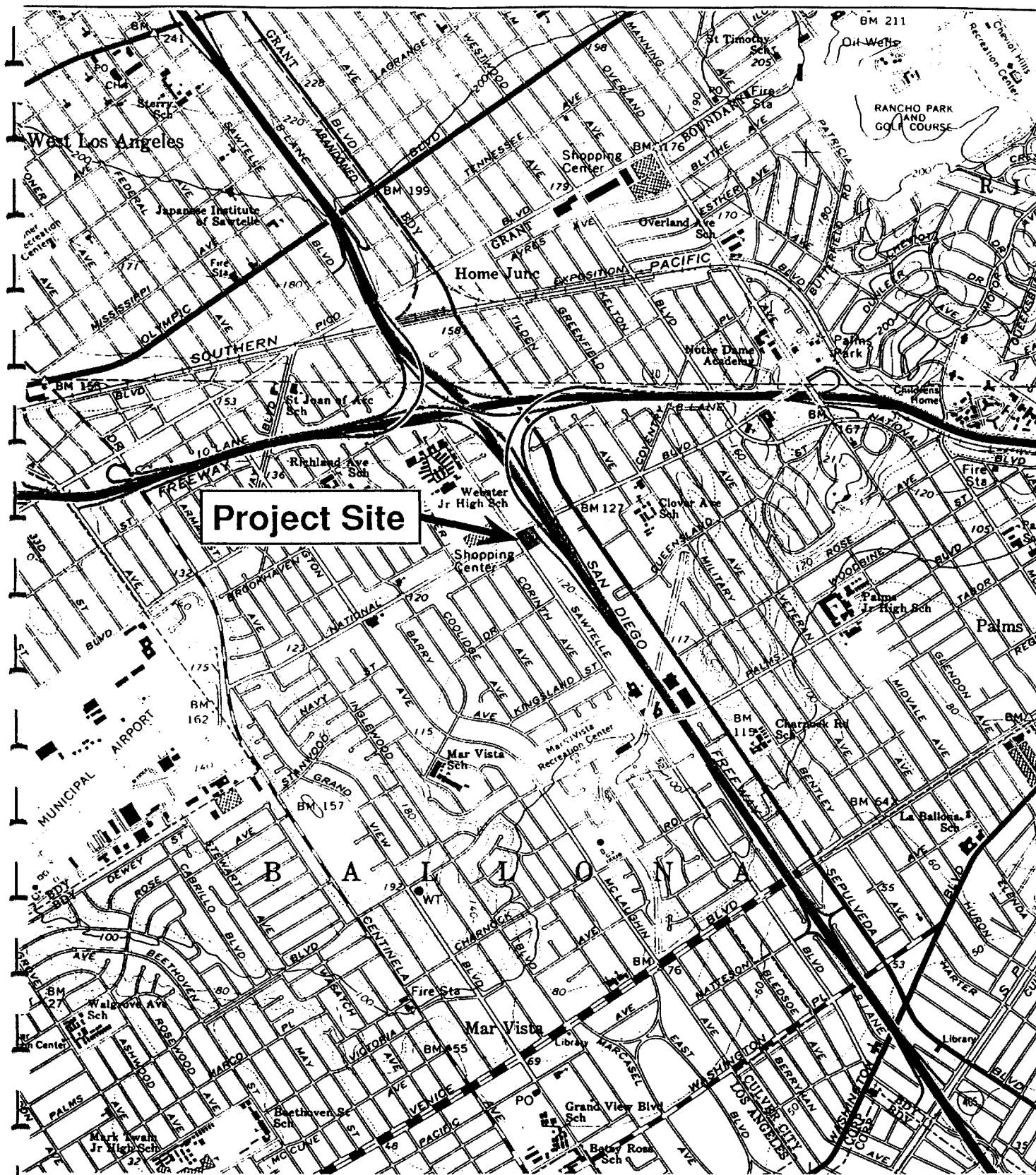
Montgomery Watson, 1992. Closure Report, Underground Storage Tank, Unocal Service Station #4357, 11280 National Boulevard, Los Angeles, California. December.

Montgomery Watson, 1993. Phase II Subsurface Environmental Investigation Report for Station 4357, 11280 National Boulevard, Los Angeles, California. April 3.

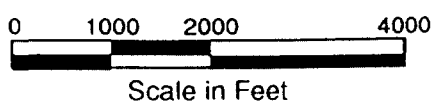
Montgomery Watson, 1994. Remedial Action Plan for Station 4357, 11280 National Boulevard, Los Angeles, California. June.

VET, 1993. Vapor Extraction Technology. Vapor Extraction Feasibility Test Report, Unocal Station 4357, 11280 National Boulevard, Los Angeles, California. October 25.

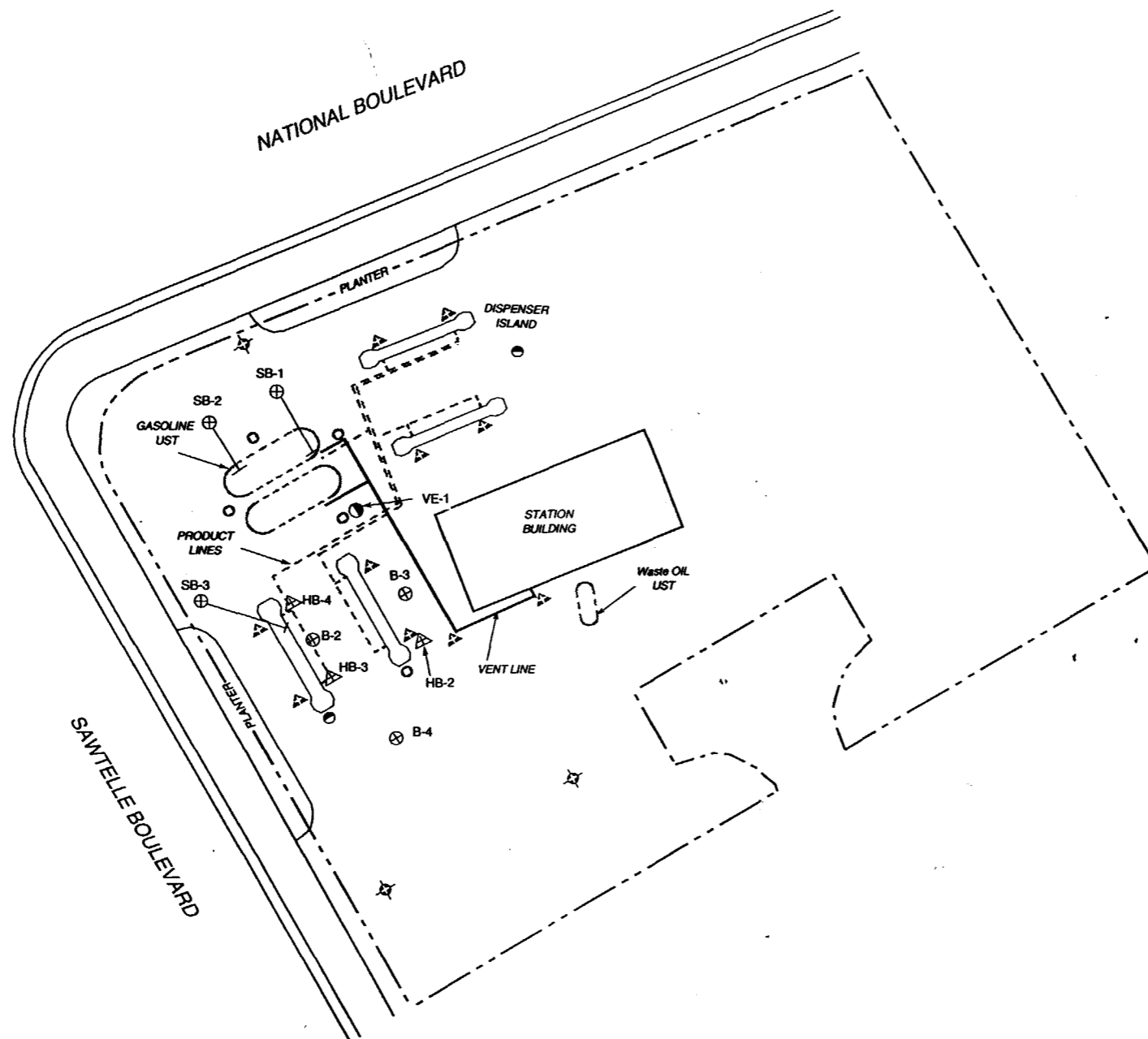
FIGURES



Source: 7.5 Minute Topographic Quadrangle Map
Beverly Hills, California, Dated 1966



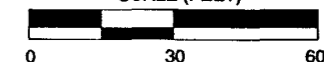
Site Location Map
Figure 1



LEGEND

- Proposed Hand Auger Boring
- Proposed Hollow Stem Boring
- Proposed Contingency Hollow Stem Auger Boring
- Possible Groundwater Monitoring Well
- HB-2 Hand Auger Boring
- B-3 Hollow Stem Boring
- SB-3 Angled Boring
- VE-1 Vadose Monitoring Well
- Product Lines
- Vent Lines

SCALE (FEET)



SITE PLAN

Unocal 76 (Tosco) Station 4357
11280 National Boulevard
Los Angeles, California

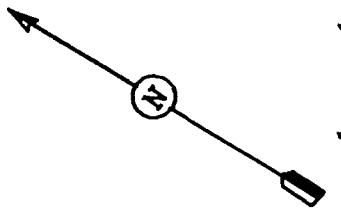
Work Plan for MTBE Investigation

Unocal 76 (Tosco) Station 4357

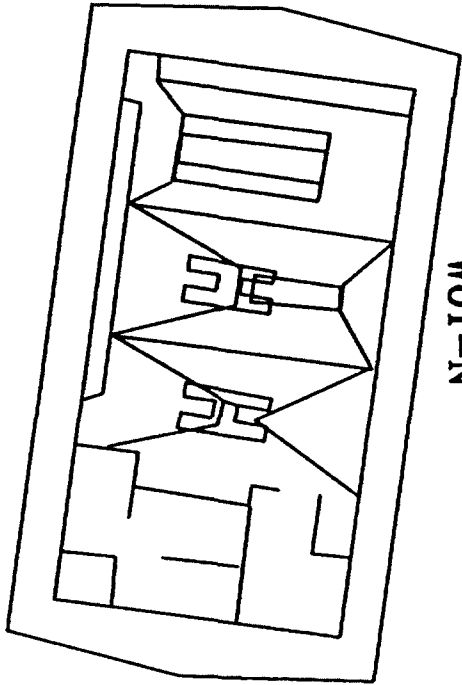
July 24, 1997

APPENDIX A

**September 1992 Tank Removal Figure
and Table of Soil Sample Results**



WOT-S
WOT-N



P10
P12
P13
P11
P9
P17
P14
P15
P18

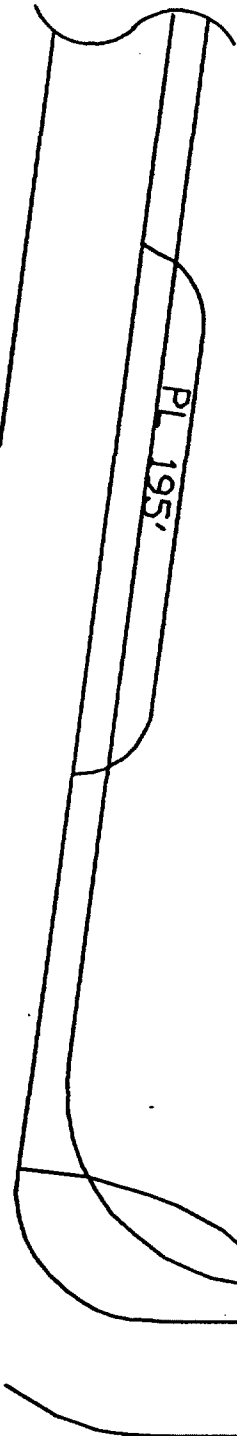
P2
P3
P7
P8
P5
P1
P4
P6

C1 C2 C3
B1 B2 B3
A1 A2 A3

SAWTELLE BOULEVARD

NOTES:

- SOIL SAMPLE



SCALE
19.3'



UNOCAL MARKETING & REFINING
UNOCAL SERVICE STATION NO. 4357
Tank Removal Soil Sample Locations

FIGURE 7

TABLE 2
UNOCAL SERVICE STATION #4357
SUMMARY OF SUBSURFACE TANK REMOVAL SOIL SAMPLE ANALYTICAL RESULTS (mg/kg)
(SEPTEMBER 1992)

LOG #	Depth (ft)	TPH-G	BENZENE	TOLUENE	ETHYL BENZENE	XYLENES	COMMENTS
A-1	12	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Bottom sample- diesel tank
A-2	12	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Bottom sample- diesel tank
A-3	12	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Bottom sample- diesel tank
B-1	12	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Bottom sample- gasoline tank
B-2	12	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Bottom sample- gasoline tank
B-3	12	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Bottom sample- gasoline tank
C-1	12	3300	ND<0.5	24	79	580	Bottom sample- gasoline tank
C-2	12	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Bottom sample- gasoline tank
C-3	12	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Bottom sample- gasoline tank
P-1	2	ND<10	ND<0.005	ND<0.005	ND<0.005	0.042	Pump island sample
P-2	2	170	0.55	1.3	1.7	1.3	Pump island sample
P-3	2	ND<10	0.014	0.025	0.047	0.33	Product piping sample
P-4	2	280	1.0	4.7	4.8	32	Pump island sample
P-5	2	ND<20	ND<0.010	ND<0.010	ND<0.010	0.066	Product piping sample
P-6	2	380	0.8	10	5.5	50	Pump island sample
P-7	2	18	0.41	0.22	0.49	2.1	Product piping sample
P-8	2	ND<10	ND<0.005	ND<0.005	0.007	0.057	Product piping sample
P-9	2	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Pump island sample
P-10	2	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Product piping sample
P-11	2	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Pump island sample
P-12	2	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Product piping sample
P-13	2	17	0.005	0.005	0.031	0.13	Product piping sample
P-14	2	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Product piping sample
P-15	2	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Pump island sample
P-16	2	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Pump island sample
P-17	2	ND<10	ND<0.005	ND<0.005	ND<0.005	ND<0.015	Product piping sample



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July 24, 1997

Original and 1 Copy - Via Hand Delivery

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Denise Kruger
SOUTHERN CALIFORNIA WATER
COMPANY
P.O. Box 9016
San Dimas, California 91773

**Re: Methyl Tertiary Butyl Ether Pollution Investigation of the
Charnock Sub-Basin
Response to Request for Work Plan for MTBE Investigation of
Potential Responsible Party Sites (File Number 96-042)
UNOCAL Service Station #4357, 11280 National Boulevard,
Los Angeles, California**

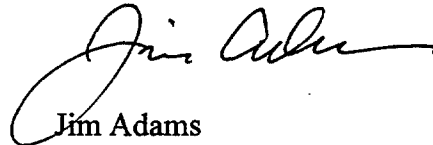
Dear Ms. Kruger and Messrs. Bacharowski, Linder and Rodriguez:

The attached *Work Plan for MTBE Investigation* responds to your request dated June 19, 1997. The Work Plan has been prepared to comply with the applicable Appendices contained in your request.

David Bacharowski, Steven Linder
Rey Rodriguez, Denise Kruger
July 24, 1997
Page 2

Please feel free to contact me at (714)428-6488, or Tosco's legal representative
Jeff Dill at (562)906-7552, if you have any questions or comments concerning the Work
Plan.

Sincerely,

A handwritten signature in cursive script, appearing to read "Jim Adams".

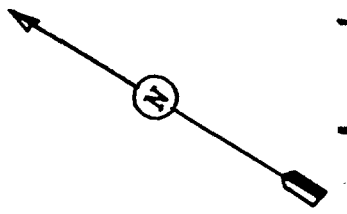
Jim Adams

cc: Richard Williams - UNOCAL (w/encl.)
Jeffrey Dill, Esq. (w/encl.)

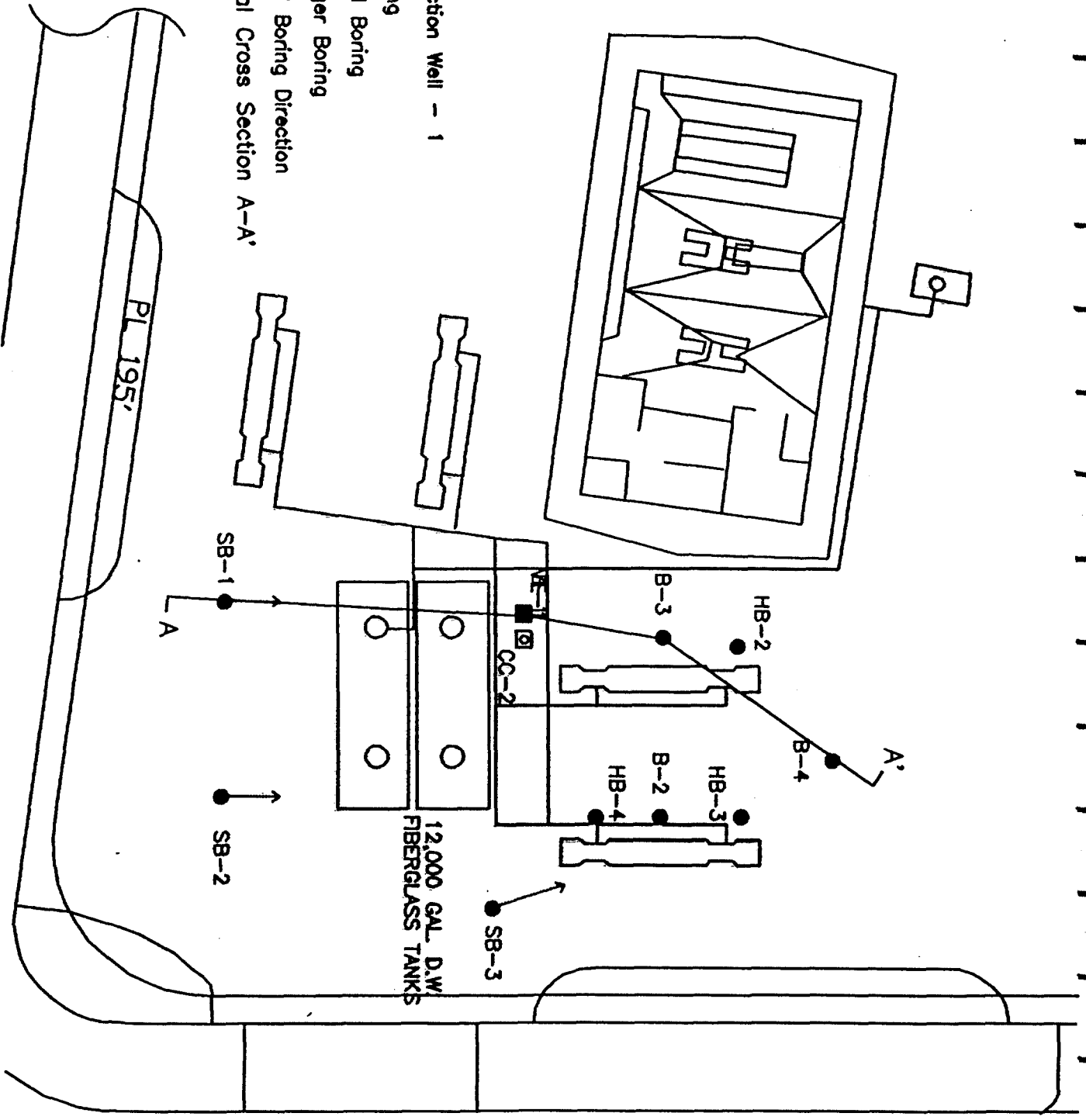
Work Plan for MTBE Investigation
Unocal 76 (Tosco) Station 4357
July 24, 1997

APPENDIX B

**March 1993 Site Assessment Figures
and Table of Soil Sample Results**



- EXPLANATION:
- VE-1 Vapor Extraction Well - 1
 - B-1 Soil Boring
 - SB-1 Slant Soil Boring
 - HB-2 Hand Auger Boring
 - Slant Soil Boring Direction
 - Geological Cross Section A-A'

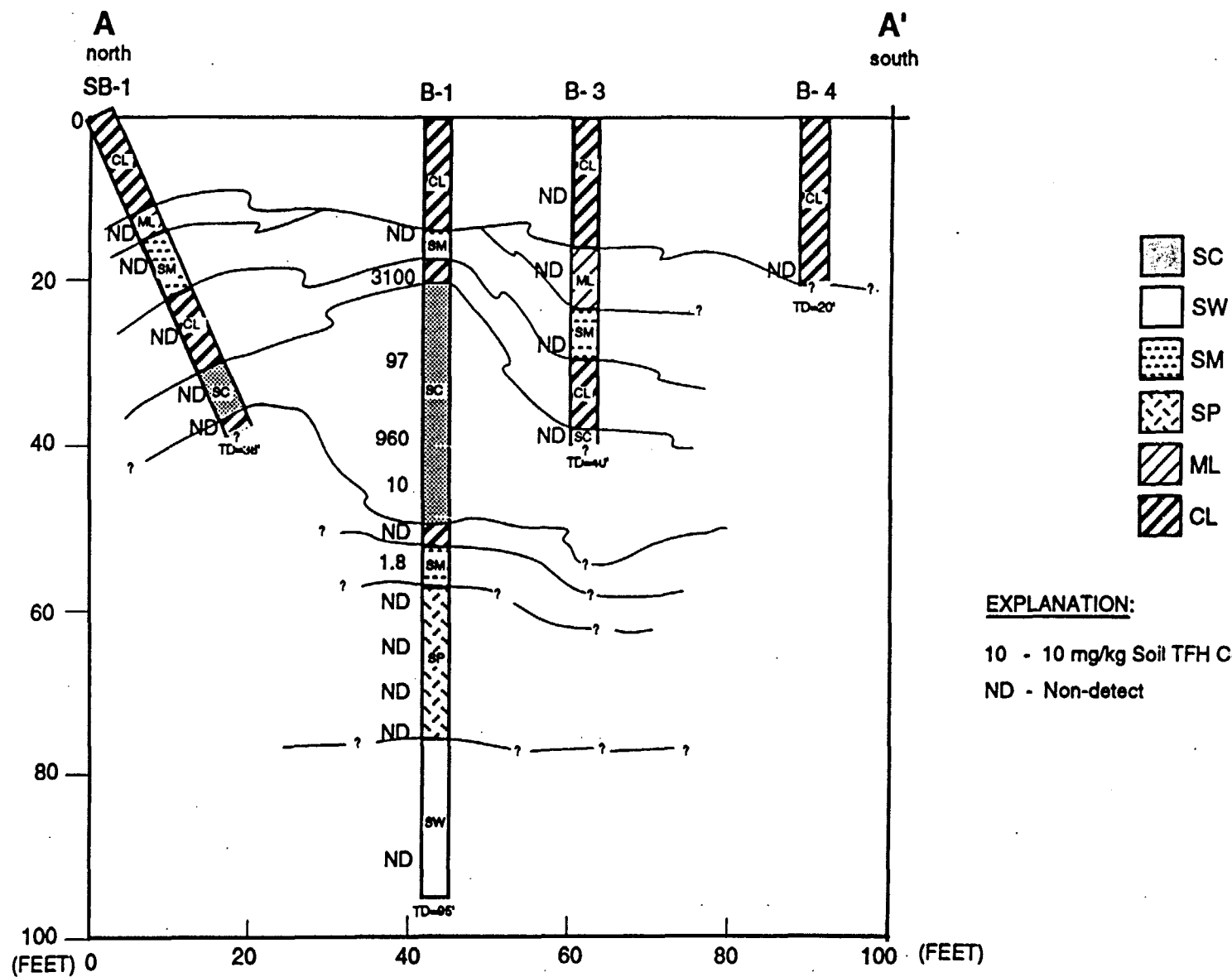


SCALE 19.3'

 MONTGOMERY WATSON
Consulting

UNOCAL MARKETING & REFINING
UNOCAL SERVICE STATION NO. 4367
Soil Boring Locations

FIGURE 4



Cross-Section A-A'
 Unocal Station 4357

Figure 3

TABLE 1
LABORATORY ANALYSES OF CONFIRMATION SOIL BORING SAMPLES
UNOCAL STATION NO. 4357
(MARCH 1993)

BORING/ DEPTH (ft)	PID (units)	TFH-G (mg/kg)	TFH-D (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Total Xylene (mg/kg)	Ethylbenzene (mg/kg)
SB-1 15	4	ND		ND	ND	ND	ND
20	2.6	ND		ND	ND	ND	ND
30	2.8	ND		ND	ND	ND	ND
40	1.1	ND		ND	ND	ND	ND
45	2.4	ND		ND	ND	ND	ND
SB-2 15	3.8	ND		ND	ND	ND	ND
20	3.8	ND		ND	ND	ND	ND
30	3.8	ND		ND	ND	ND	ND
40	3.8	ND		ND	ND	ND	ND
SB-3 15	2.6	ND		ND	ND	ND	ND
30	3	ND		ND	ND	ND	ND
40	2	ND		ND	ND	ND	ND
50	2	ND		ND	ND	ND	ND
B-1 15	35	ND		ND	0.011	0.17	0.03
20	185	3100	ND<10	ND<0.5	34	520	100
30	172	97		ND<0.025	0.99	16	2.5
40	152	960		0.9	70	160	31
45	40	10		0.007	0.54	1.1	0.16
50	22	ND		ND	0.051	0.091	0.009
55	15.2	1.8		ND	0.056	0.069	0.013
60	24	ND		ND	0.031	0.063	0.009
65	32	ND		ND	ND	ND	ND
70	5	ND		ND	0.006	0.035	ND
75	18	ND		ND	0.005	0.03	0.005
90	18	ND		ND	ND	0.019	ND
B-2 15	172	8		0.047	0.019	0.052	0.016
20	152	ND	ND<10	0.19	0.006	0.087	ND
B-3 10	1	ND		ND	ND	ND	ND
20	1	ND		ND	ND	ND	ND
30	0	ND		ND	ND	ND	ND
40	1	ND		ND	ND	ND	ND
B-4 20	0	ND		ND	ND	ND	ND
HB-2 10	1.5	2.3		ND	ND	0.043	0.012
HB-3 10	0	ND		ND	ND	ND	ND
HB-4 10	0	ND		ND	ND	ND	ND

NOTE:

ND Indicates constituents not detected above analytical limit:

TFH-G - Gasoline - ND < 1.0 mg/kg

TFH-D - Diesel - ND < 10 mg/kg

Benzene - ND < 0.005 mg/kg

Toluene - ND < 0.005 mg/kg

Ethylbenzene - ND < 0.005 mg/kg

Xylenes - ND < 0.015 mg/kg

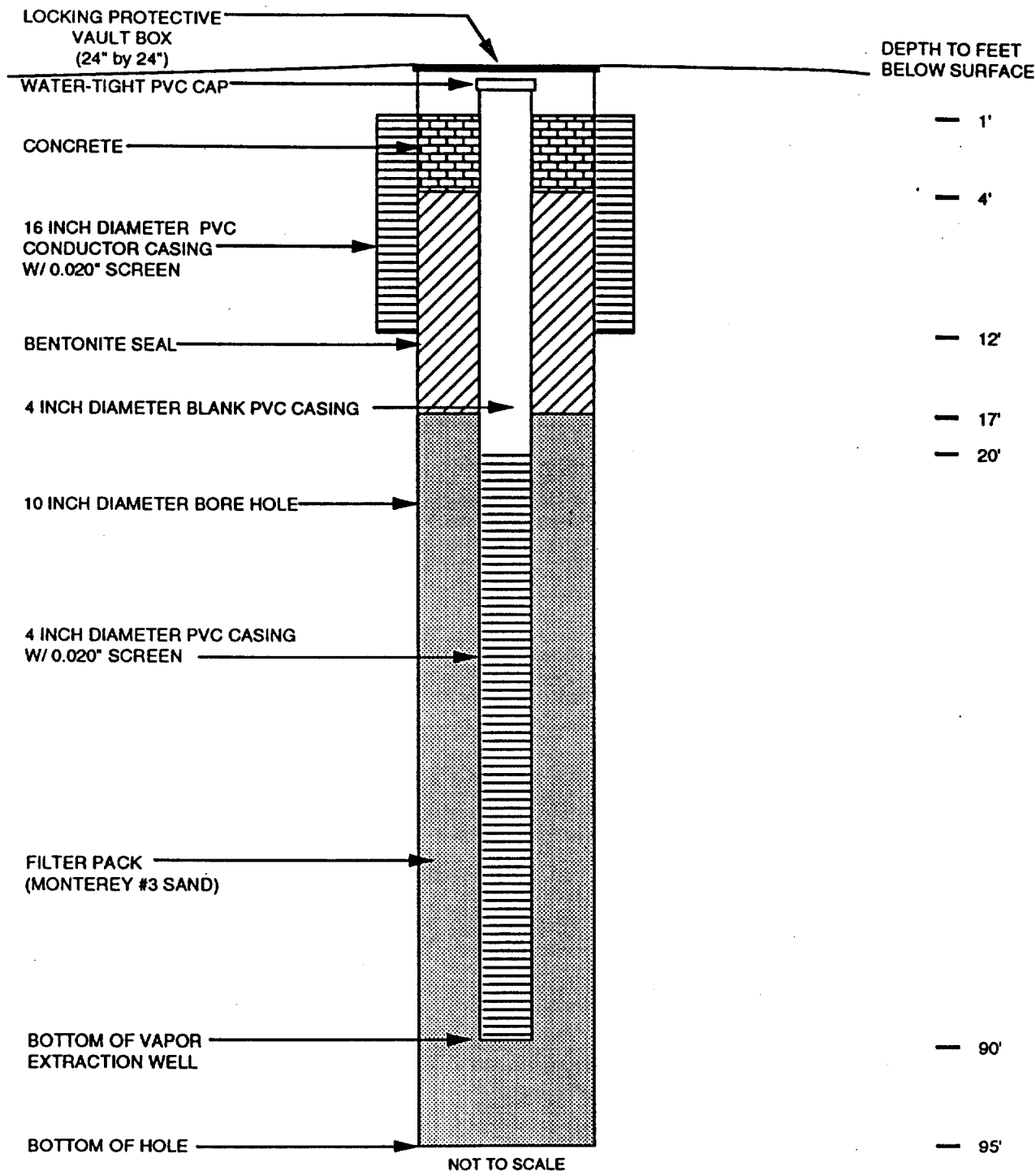
Shaded area means results above the detection limits.

Blank space means not analyzed.

TABLE 3
UNOCAL SERVICE STATION #4357
GEOTECHNICAL AND CHEMICAL ANALYSIS RESULTS FOR SOIL SAMPLE B-1-40'
(MARCH 1993)

PARAMETER	METHOD	RESULT
Porosity	API RP-40	34.3 %
Bulk Density	API RP-40	1.73 g/cc
Hydraulic Conductivity	EPA 9100	7.36×10^{-6}
Water Saturation	Dean-Stark	91.6 %
Contaminant Saturation	Dean-Stark	<0.1 %
Air Permeability, Native	API RP-40	13.5 md
Particle Size		see Appendix D
pH	EPA 9045	7.9 units
Nitrogen, as Ammonia	EPA 350.3	ND<10 mg/kg
Phosphate	EPA 300.0	ND<5 mg/kg
Heterotrophic Plate Count	M223	3.0×10^3 CFU/g
Total Organic Carbons	EPA 415.1	770 mg O ₂ /kg)

K = Permeability
md = Millidarcys
gm = Grams
cc = Cubic Centimeters
CFU/g = Colony Forming Units/grams



UNOCAL SERVICE STATION #4357
VAPOR EXTRACTION WELL VE-1
FIGURE 6

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
			6" of asphalt		
			LEAN CLAY, dark brown, moist, firm to stiff, 90% clay with medium plasticity, 15% silt, 5% coarse, subangular sand, micaceous. Contains minor amounts of fine, subangular gravel.	CL	Time = 0718 PID = 0.0 units No hydrocarbon odor
5.0					
10			LEAN CLAY, dark brown, moist, firm to stiff, 90% clay with medium plasticity, 15% silt, 5% coarse, subangular sand, micaceous. Contains minor amounts of fine, subangular gravel.	CL	
					Time = 0823 PID = 0.0 units
15		50-6	SILTY SAND WITH GRAVEL, brown to dark brown, moist, medium dense, 15% non-plastic silt, 30% fine sand, 40% medium, subangular sand, 15% fine to medium, subangular gravel.	SM	Time = 0839 PID = 35 units Recovery = 6" No hydrocarbon odor
20		5 20 28	SILTY SAND WITH GRAVEL, brown to dark brown, moist, medium dense, 10% clay with low plasticity, 25% non-plastic silt, 25% fine sand, 25% medium, subangular sand, 15% fine to medium, subangular gravel.	SM	Time = 0851 PID = 185 units Recovery = 13" Slight hydrocarbon odor
25					

METHOD OF DRILLING	Hollow stem auger	WELL DIAMETER	4.0 inches
HOLE DIAMETER	10.0 inches	WELL MATERIAL	PVC-0.020" SCR
COMPLETION DEPTH	95 feet	WELL DEVELOPMENT	NA

BORING NUMBER B-1 CLIENT UNOCAL Marketing and Refining
 DATE DRILLED 3/3/93 PROJECT Service Station #4357
 GEOLOGIST Manuel Saenz

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
30		50-6	LEAN CLAY, dark brown, slightly moist, stiff 85% clay with low plasticity, 10% silt, 5% fine sand, mottled. Contains trace amounts of gray-brown discoloration.	CL	Driller notes hard drilling at 28' bgl. Time = 0900 PID = 172 units Recovery = 8" Moderate hydrocarbon odor (gasoline)
35			CLAYEY SAND, dark brown, moist, dense, 15% clay with low plasticity, 50% fine sand, 25% medium, subangular sand, 10% fine, subangular gravel.	SC	
40		28 50-5	CLAYEY SAND, brown to dark brown, moist, 40% clay with low to medium plasticity, 10% silt, 50% fine sand.	SC	Time = 0912 PID = 152 units Recovery = 15" Moderate to strong hydrocarbon odor (gasoline)
45		50-6	CLAYEY SAND, brown to dark brown, moist, 45% clay with low to medium plasticity, 50% fine sand, 5% fine, subangular gravel.	SC	Time = 1010 PID = 40 units Recovery = 8" Slight hydrocarbon odor
50		50-6	CLAYEY SAND, brown to dark brown, moist, 25% clay with low to medium plasticity, 55% fine sand, 20% fine to coarse, subangular gravel.	SC	Time = 1031 PID = 22 units Recovery = 15" Slight hydrocarbon odor

METHOD OF DRILLING	<u>Hollow stem auger</u>	WELL DIAMETER	<u>4.0 inches</u>
HOLE DIAMETER	<u>10.0 inches</u>	WELL MATERIAL	<u>PVC-0.020" SCR</u>
COMPLETION DEPTH	<u>95 feet</u>	WELL DEVELOPMENT	<u>NA</u>

BORING NUMBER

B-1

CLIENT

UNOCAL Marketing and Refining

DATE DRILLED

3/3/93

PROJECT

Service Station #4357

GEOLOGIST

Manuel Saenz/Dan Johnson

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
		50-6	CLAYEY SAND, brown to dark brown, moist, 25% clay with low to medium plasticity, 55% fine sand, 20% fine to coarse, subangular gravel.	SC	Time = 1031 PID = 22 units Recovery = 15" Slight hydrocarbon odor
55		50-6	LEAN CLAY, light brown, slightly moist to moist, stiff 70% clay with low plasticity, 30% silt, slightly oxidized, micaceous.	CL	Time = 1038 PID = 15.2 units Recovery = 7" No hydrocarbon odor
			SILTY SAND, brown to dark brown, moist, dense, 15% silt, 70% fine sand, 5% medium, subangular sand, 10% fine, subangular gravel.	SM	
60		9 17 22	SAND, light brown, moist, medium dense, 10% non-plastic silt, 90% very fine to fine sand.	SP	Time = 1038 PID = 24 units Recovery = 7" Slight hydrocarbon odor
65		10 27 36	SAND, light yellow-brown, moist, dense, 15% non-plastic silt, 80% fine sand, 5% medium, subrounded sand. Contains trace amounts of dark brown silt nodules.	SP	Time = 1035 PID = 32 units Recovery = 10" Slight hydrocarbon odor
70		17 50	SAND, light yellow-brown, moist, very dense, 15% non-plastic silt, 80% fine sand, 5% medium, subrounded sand. Contains trace amounts of dark brown silt nodules.	SP	Time = 1115 PID = 5 units Recovery = 12" No hydrocarbon odor
75		9 28 35	SAND, yellow-brown, moist, dense, 75% fine sand, 25% medium, subrounded sand. Contains trace amounts of coarse, subrounded sand.	SP	Time = 1130 PID = 18 units Recovery = 14" No hydrocarbon odor

METHOD OF DRILLING

Hollow stem auger

WELL DIAMETER

4.0 inches

HOLE DIAMETER

10.0 inches

WELL MATERIAL

PVC-0.020" SCR

COMPLETION DEPTH

95 feet

WELL DEVELOPMENT

NA

BORING NUMBER B-1 CLIENT UNOCAL Marketing and Refining
 DATE DRILLED 3/3/93 PROJECT Service Station #4357
 GEOLOGIST Manuel Saenz/Dan Johnson

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
		9 28 35	SAND, yellow-brown, moist, dense, 75% fine sand, 25% medium, subrounded sand. Contains trace amounts of coarse, subrounded sand.	SP	Time = 1130 PID = 18 units Recovery = 14" No hydrocarbon odor
80		28 50- 6	SAND, orange-brown, moist, very dense, 35% fine sand, 30% medium, subangular to subrounded sand 20% coarse, subrounded sand, 15% fine, subrounded to rounded gravel. Contains trace amounts of brown, fine sand nodules.	SW	Time = 1150 PID = 38 units Recovery = 16" Slight hydrocarbon odor
85		18 22 25	SAND, orange-brown, moist, medium dense, 30% fine sand, 40% medium, subrounded sand 20% coarse, subrounded sand, 10% fine, subrounded to rounded gravel. Contains trace amounts of brown, fine sand nodules.	SW	Time = 1200 PID = 12 units Recovery = 16" Slight hydrocarbon odor
90		19 25 32	SAND, orange-brown, moist, medium dense, 30% fine sand, 40% medium, subrounded sand 20% coarse, subrounded sand, 10% fine, subrounded to rounded gravel. Contains trace amounts of brown, fine sand nodules.	SW	Time = 1210 PID = 18 units Recovery = 12" Slight hydrocarbon odor
95		19 25 32	SAND, orange-brown, moist, medium dense, 30% fine sand, 40% medium, subrounded sand 20% coarse, subrounded sand, 10% fine, subrounded to rounded gravel. Contains trace amounts of brown, fine sand nodules.	SW	Time = 1220 PID = 15 units Recovery = 14" Slight hydrocarbon odor
BOTTOM OF HOLE					
100			Groundwater not encountered.		

METHOD OF DRILLING Hollow stem auger WELL DIAMETER 4.0 inches
 HOLE DIAMETER 10.0 inches WELL MATERIAL PVC-0.020" SCR
 COMPLETION DEPTH 95 feet WELL DEVELOPMENT NA

BORING NUMBER	<u>B-2</u>	CLIENT	<u>UNOCAL Marketing and Refining</u>
DATE DRILLED	<u>3/4/93</u>	PROJECT	<u>Service Station #4357</u>
		GEOLOGIST	<u>Manuel Saenz</u>

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
			10" of concrete		Time = 0735 Airknife down to 5' bgl.
5.0			LEAN CLAY, dark brown, moist, stiff, 85% clay with low plasticity, 10% non-plastic silt, 5% fine sand, Contains minor amounts of fine, subangular gravel.	CL	Time = 0802 PID = 77 units Recovery = 6" No hydrocarbon odor
			LEAN CLAY, dark brown, moist, stiff, 85% clay with low plasticity, 10% non-plastic silt, 5% fine sand, Contains minor amounts of fine, subangular gravel.	CL	Time = 0839 PID = 180 units No hydrocarbon odor
10		7	LEAN CLAY, green-brown to brown, moist, firm to soft, 80% clay with medium plasticity, 20% silt. Contains minor amounts of fine, subangular gravel.	CL	Time = 0822 PID = 123 units Recovery = 18" Moderate hydrocarbon odor
		7			
		9			
15		10	SILT WITH CLAY, green-brown to brown, moist, soft, 40% clay with medium plasticity, 60% silt. Contains minor amounts of oxidation spots.	ML	Time = 0844 PID = 172 units Recovery = 18" Slight to moderate hydrocarbon odor
		12			
		17			
			LEAN CLAY, green-brown to dark brown, moist, firm to soft, 80% clay with medium plasticity, 20% silt.	CL	
20		12	SILT WITH CLAY, dark brown, moist, soft, 40% clay with medium plasticity, 45% silt, 15% fine sand.	ML	Time = 0917 PID = 152 units Recovery = 18" Slight hydrocarbon odor
		12			
		15			
			LEAN CLAY, dark brown, moist, firm, 75% clay with low plasticity, 20% silt, 5% fine sand.	CL	PID = 138 units Slight hydrocarbon odor
25			LEAN CLAY, dark brown, moist, stiff, 75% clay with low plasticity, 20% silt, 5% fine sand. Contains slight black discoloration.	CL	T= 0935 PID = 122 units Slight hydrocarbon odor
			Abandoned boring at 28' bgl.		
			BOTTOM OF HOLE		

METHOD OF DRILLING	Hollow stem auger	WELL DIAMETER	NA
HOLE DIAMETER	8.0 inches	WELL MATERIAL	NA
COMPLETION DEPTH	28 feet	WELL DEVELOPMENT	NA

BORING NUMBER B-3 CLIENT UNOCAL Marketing and Refining
 DATE DRILLED 3/3/93 PROJECT Service Station #4357
 GEOLOGIST Manuel Saenz

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
			10" of concrete		
			LEAN CLAY, dark brown, moist, soft to firm, 90% clay with medium plasticity, 10% silt, micaceous. Contains minor amounts of fine, subangular gravel.	CL	Time = 1335 Airknife down to 5' bgl. Time = 1521 PID = 1.0 units No hydrocarbon odor
5.0			LEAN CLAY, dark brown, moist, firm to stiff, 80% clay with medium plasticity, 15% silt, 5% coarse, subangular sand, micaceous. Contains minor amounts of fine, subangular gravel.	CL	Time = 1700 PID = 1.0 units No hydrocarbon odor
10		30	LEAN CLAY, dark brown, moist, firm to stiff, 80% clay with medium plasticity, 15% silt, 5% coarse, subangular sand. Contains minor amounts of fine, subangular gravel.	CL	Time = 1712 PID = 1.0 units Recovery = 8" No hydrocarbon odor
		33			
		38			
15		15	SILT WITH CLAY, dark brown, moist, soft, 15% clay with medium plasticity, 75% silt, 5% fine sand, 5% fine, subangular gravel, micaceous.	ML	Time = 1719 PID = 2.0 units Recovery = 16" No hydrocarbon odor
		18			
		22			
20		15	SILT WITH CLAY, dark brown, moist, soft, 15% clay with medium plasticity, 70% silt, 10% fine sand, 5% fine, subangular gravel, micaceous.	ML	Time = 1724 PID = 1.0 units Recovery = 12" No hydrocarbon odor
		18			
		20			
			?	SM	
25			SILTY SAND, brown, moist, medium dense, 20% non-plastic silt, 50% fine sand, 25% medium, subangular sand, micaceous.		
			?		
			LEAN CLAY, dark brown, moist, stiff, 90% clay with low plasticity, 10% silt, slightly mottled.	CL	

METHOD OF DRILLING

Hollow stem auger

WELL DIAMETER

NA

HOLE DIAMETER

8.0 inches

WELL MATERIAL

NA

COMPLETION DEPTH

40 feet

WELL DEVELOPMENT

NA

BORING NUMBER B-4 **CLIENT** UNOCAL Marketing and Refining
DATE DRILLED 3/5/93 **PROJECT** Service Station #4357
GEOLOGIST Manuel Saenz

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
			5" of asphalt		Time = 1505
			LEAN CLAY, gray-black, moist, stiff, 90% clay with low plasticity, 10% non-plastic silt. Contains minor amounts of black disseminations.	CL	Time = 1549 PID = 0.0 No hydrocarbon odor Airknife down to 5' bgl
5.0			LEAN CLAY, brown-black, moist, stiff, 90% clay with low plasticity, 10% non-plastic silt. Contains minor amounts of black disseminations.	CL	Time = 1610 PID = 0.0 No hydrocarbon odor
10		9 18 22	LEAN CLAY, brown, moist, soft to firm, 90% clay with medium plasticity, 10% silt. Contains minor amounts of oxidation and black organics.	CL	Time = 1615 PID = 0.0 units Recovery = 18" No hydrocarbon odor
15			LEAN CLAY, brown, moist, soft to firm, 90% clay with medium plasticity, 10% silt. Contains minor amounts of oxidation and black organics.	CL	
20		6 11 13	LEAN CLAY, brown, moist, soft to firm, 90% clay with medium plasticity, 10% silt. Contains minor amounts of oxidation and black organics.	CL	Time = 1625 PID = 0.0 units Recovery = 18" No hydrocarbon odor
			BOTTOM OF HOLE		
			Groundwater not encountered		
25					

METHOD OF DRILLING	<u>Hollow stem auger</u>	WELL DIAMETER	<u>NA</u>
HOLE DIAMETER	<u>8.0 inches</u>	WELL MATERIAL	<u>NA</u>
COMPLETION DEPTH	<u>20 feet</u>	WELL DEVELOPMENT	<u>NA</u>

BORING NUMBER	HB-2	CLIENT	UNOCAL Marketing and Refining
DATE DRILLED	3/4/93	PROJECT	Service Station #4357
INCLINATION	10°	GEOLOGIST	Manuel Saenz

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
			8" of concrete 2" of pea gravel		Time = 1255 Airknife down to 5' bgl.
			LEAN CLAY, dark brown, moist, firm to stiff, 90% clay with low plasticity, 10% silt, slightly micaceous. Contains minor amounts of dark brown-black discolorations.	CL	Time = 1330 PID = 0.0 units No hydrocarbon odor
2.5			LEAN CLAY, dark brown, moist, firm to stiff, 70% clay with low plasticity, 10% silt, 20% fine to coarse, subangular sand, slightly micaceous.	CL	Time = 1350 PID = 1.0 units No hydrocarbon odor
5			LEAN CLAY, dark brown, moist, firm to stiff, 70% clay with low plasticity, 10% silt, 20% fine to coarse, subangular sand, slightly micaceous.	CL	Time = 1435 PID = 1.0 units No hydrocarbon odor
7.5			LEAN CLAY, dark brown, moist, firm to stiff, 65% clay with low plasticity, 10% silt, 10% fine sand, 15% coarse, subangular sand.	CL	Time = 1450 PID = 2.0 units No hydrocarbon odor
10			LEAN CLAY, dark brown, moist, firm to stiff, 65% clay with low plasticity, 10% silt, 25% coarse, subangular sand.	CL	Time = 1636 Recovery = 6" PID = 1.5 units No hydrocarbon odor
			BOTTOM OF HOLE		
			Groundwater not encountered.		
12.5					

METHOD OF DRILLING	Hand auger	WELL DIAMETER	NA
HOLE DIAMETER	3.0 inches	WELL MATERIAL	NA
COMPLETION DEPTH	10 feet	WELL DEVELOPMENT	NA



BORING NUMBER HB-3 CLIENT UNOCAL Marketing and Refining
 DATE DRILLED 3/5/93 PROJECT Service Station #4357
 INCLINATION 10° GEOLOGIST Manuel Saenz

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
			8" of concrete		Time = 1303 Airknife down to 5' bgl.
			LEAN CLAY, dark brown, moist, stiff, 80% clay with low plasticity, 20% silt, micaceous.	CL	Time = 1308 PID = 0.0 units No hydrocarbon odor
2.5			LEAN CLAY, dark brown, moist, stiff, 80% clay with low plasticity, 20% silt, micaceous.	CL	Time = 1325 PID = 0.0 units No hydrocarbon odor
5			LEAN CLAY, dark brown, moist, stiff, 85% clay with low plasticity, 15% silt, slightly micaceous and mottled.	CL	Time = 1430 PID = 0.0 units No hydrocarbon odor
7.5			LEAN CLAY, dark brown, moist, stiff, 85% clay with low plasticity, 15% silt, slightly micaceous and mottled.	CL	Time = 1442 PID = 0.0 units No hydrocarbon odor
10			LEAN CLAY, dark brown, moist, stiff, 85% clay with low plasticity, 15% silt, slightly micaceous.	CL	Time = 1453 PID = 0.0 units Recovery = 6" No hydrocarbon odor
			BOTTOM OF HOLE		
			Groundwater not encountered.		
12.5					

METHOD OF DRILLING

Hand auger

WELL DIAMETER

NA

HOLE DIAMETER

3.0 inches

WELL MATERIAL

NA

COMPLETION DEPTH

10 feet

WELL DEVELOPMENT

NA



BORING NUMBER HB-3 CLIENT UNOCAL Marketing and Refining
 DATE DRILLED 3/5/93 PROJECT Service Station #4357
 INCLINATION 10° GEOLOGIST Manuel Saenz

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
			8" of concrete		Time = 1045
			2" of coarse, subangular to surrounded sand		Airknife down to 5' bgl.
			LEAN CLAY, dark brown, moist, stiff, 80% clay with low plasticity, 20% silt, micaceous.	CL	Time = 1112
2.5			LEAN CLAY, dark brown, moist, stiff, 80% clay with low plasticity, 20% silt, micaceous.	CL	PID = 0.0 units
					No hydrocarbon odor
5			LEAN CLAY, dark brown, moist, stiff, 65% clay with low plasticity, 35% silt, micaceous.	CL	Time = 1130
					PID = 0.0 units
					No hydrocarbon odor
7.5			SILT WITH CLAY, dark brown, moist, firm to stiff, 30% clay with low plasticity, 70% silt, micaceous. Contains minor amounts of fine, subangular gravel.	ML	Time = 1141
					PID = 0.0 units
					No hydrocarbon odor
10			LEAN CLAY, dark brown, moist, stiff, 65% clay with low plasticity, 35% silt, micaceous.	CL	Time = 1153
					PID = 0.0 units
					Recovery = 6"
					No hydrocarbon odor
			BOTTOM OF HOLE		
			Groundwater not encountered.		
12.5					

METHOD OF DRILLING Hand auger WELL DIAMETER NA
 HOLE DIAMETER 3.0 inches WELL MATERIAL NA
 COMPLETION DEPTH 10 feet WELL DEVELOPMENT NA



BORING NUMBER SB-1 CLIENT UNOCAL Marketing and Refining
 DATE DRILLED 3/3/93 PROJECT Service Station #4357
 INCLINATION 25° GEOLOGIST Manuel Saenz

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
			5" of asphalt		Date = 3/4/93 Time = 1341
			LEAN CLAY, dark brown, slightly moist, stiff, 80% clay with medium plasticity, 15% silt, 5% fine sand, Contains minor amounts of black disseminations and slightly mottled.	CL	Time = 1802 PID = 0.0 No hydrocarbon odor Airknife down to 5' bgl.
5.0			LEAN CLAY, dark brown, slightly moist, stiff, 80% clay with medium plasticity, 15% silt, 5% fine sand, Contains minor amounts of black disseminations and slightly mottled.	CL	Date = 3/5/93 Time = 0703 PID = 0.0 units No hydrocarbon odor Time = 0730 PID = 5.0 units No hydrocarbon odor
10		4 13 16	LEAN CLAY, dark brown, slightly moist, stiff, 55% clay with medium plasticity, 35% silt, 5% fine sand, %5 fine, subangular gravel.	CL	Time = 0748 PID = 4.2 units Recovery = 15" No hydrocarbon odor
15		15 18 22	— ? — SILT WITH CLAY, dark brown, moist, soft, 20% clay with medium plasticity, 70% silt, 5% fine sand, 5% fine, subangular gravel, micaceous.	ML	Time = 0754 PID = 4.0 units Recovery = 15" No hydrocarbon odor
20		15 18 20	— ? — SILTY SAND, brown, moist, medium dense, 10% clay with low plasticity, 20% non-plastic silt, 65% fine sand, 5% fine, subangular gravel, micaceous.	SM	Time = 0757 PID = 2.6 units Recovery = 18" No hydrocarbon odor
25			SILTY SAND, brown, moist, medium dense, 10% clay with low plasticity, 20% non-plastic silt, 60% fine sand, 10% fine to coarse, subangular gravel, micaceous.	SM	Time = 0801 PID = 3.2 units No hydrocarbon odor

METHOD OF DRILLING

Hollow stem auger

WELL DIAMETER

NA

HOLE DIAMETER

8.0 inches

WELL MATERIAL

NA

COMPLETION DEPTH

45 feet

WELL DEVELOPMENT

NA



BORING NUMBER	<u>SB-1</u>	CLIENT	<u>UNOCAL Marketing and Refining</u>
DATE DRILLED	<u>3/5/93</u>	PROJECT	<u>Service Station #4357</u>
INCLINATION	<u>25°</u>	GEOLOGIST	<u>Manuel Saenz</u>

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
			SILTY SAND, brown, moist, medium dense, 10% clay with low plasticity, 20% non-plastic silt, 60% fine sand, 10% fine to coarse, subangular gravel, micaceous.	SM	Time = 0801 PID = 3.2 units No hydrocarbon odor
30		13 20 27	LEAN CLAY, dark brown, moist, stiff, 85% clay with low plasticity, 15% silt, slightly mottled. Contains minor amounts of gray-black discoloration, and fine, subangular to subrounded gravel.	CL	Time = 0808 PID = 2.8 units Recovery = 18" No hydrocarbon odor
35			LEAN CLAY, dark brown, moist, stiff, 85% clay with low plasticity, 15% silt, slightly mottled. Contains minor amounts of gray-black discoloration, and coarse, subangular sand.	CL	Time = 0810 PID = 5.0 units No hydrocarbon odor
40		17 21 24	CLAYEY SAND, brown to dark brown, moist, medium dense, 20% clay with low to medium plasticity, 15% silt, 65% fine sand.	SC	Time = 0815 PID = 1.1 units Recovery = 17" No hydrocarbon odor
45			CLAY, dark brown, moist, stiff, 90% clay with low plasticity, 10% silt. Contains minor amounts of fine, subangular gravel.	CL	Time = 0926 PID = 3.0 units No hydrocarbon odor
			SILTY SAND WITH CLAY, brown to orange-brown, moist, medium dense, 15% clay with low plasticity, 20% non-plastic silt, 30% fine sand, 25% medium, subangular to subrounded sand, 15% fine to coarse, subangular gravel, slightly oxidized.	SM	Time = 0931 PID = 2.4 units Recovery = 8" No hydrocarbon odor
			BOTTOM OF HOLE		
			Groundwater not encountered		

METHOD OF DRILLING	<u>Hollow stem auger</u>	WELL DIAMETER	<u>NA</u>
HOLE DIAMETER	<u>8.0 inches</u>	WELL MATERIAL	<u>NA</u>
COMPLETION DEPTH	<u>45 feet</u>	WELL DEVELOPMENT	<u>NA</u>



BORING NUMBER	<u>SB-2</u>	CLIENT	<u>UNOCAL Marketing and Refining</u>
DATE DRILLED	<u>3/5/93</u>	PROJECT	<u>Service Station #4357</u>
INCLINATION	<u>20°</u>	GEOLOGIST	<u>Manuel Saenz</u>

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
			4" of asphalt		Date = 3/4/93 Time = 1800 PID = 0.0 Time = 1802 PID = 0.0 No hydrocarbon odor Airknife down to 5' bgl.
5.0			LEAN CLAY, dark brown, slightly moist, firm to stiff, 80% clay with low plasticity, 15% silt, 5% fine to coarse, subangular gravel. Contains minor amounts of black disseminations and slightly mottled.	CL	
			SAND, orange-brown, slightly moist, stiff, 10% silt, 25% fine sand, 65% medium sand, highly oxidized.	SP	Time = 1825 PID = 0.0 No hydrocarbon odor
			LEAN CLAY, dark brown, slightly moist, firm to stiff, 60% clay with low plasticity, 40% silt.	CL	
10		8 12 15	LEAN CLAY, dark brown, slightly moist, stiff, 60% clay with low plasticity, 40% silt. Contains minor amounts of fine to medium, subangular gravel.	CL	Date = 3/5/93 Time = 1039 PID = 4.2 units Recovery = 18" No hydrocarbon odor
15		10 18 22	LEAN CLAY, dark brown, slightly moist, to stiff, 75% clay with low plasticity, 25% silt. Contains minor amounts of fine to medium, subangular gravel.	CL	Time = 1043 PID = 3.8 units Recovery = 18" No hydrocarbon odor
20		10 15 23	— ? — SILT WITH CLAY, dark brown, moist, soft, 40% clay with low plasticity, 60% silt, micaceous. Contains minor amounts of coarse, subrounded sand.	ML	Time = 1043 PID = 3.8 units Recovery = 18" No hydrocarbon odor
25			— ? — LEAN CLAY, dark brown, slightly moist, to stiff, 65% clay with low plasticity, 30% silt, 5% fine sand, mottled and micaceous.	CL	Time = 1053 PID = 4.4 units No hydrocarbon odor

METHOD OF DRILLING	<u>Hollow stem auger</u>	WELL DIAMETER	<u>NA</u>
HOLE DIAMETER	<u>8.0 inches</u>	WELL MATERIAL	<u>NA</u>
COMPLETION DEPTH	<u>40 feet</u>	WELL DEVELOPMENT	<u>NA</u>



BORING NUMBER	<u>SB-2</u>	CLIENT	<u>UNOCAL Marketing and Refining</u>
DATE DRILLED	<u>3/5/93</u>	PROJECT	<u>Service Station #4357</u>
INCLINATION	<u>20°</u>	GEOLOGIST	<u>Manuel Saenz</u>

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
			LEAN CLAY, dark brown, slightly moist, to stiff, 65% clay with low plasticity, 30% silt, 5% fine sand, mottled and micaceous.	CL	Time = 1053 PID = 4.4 units No hydrocarbon odor
30		19 27 30	LEAN CLAY, dark brown, slightly moist, to stiff, 75% clay with low plasticity, 25% silt, mottled and micaceous. Contains minor amounts of coarse, subangular gravel.	CL	Time = 1055 PID = 3.8 units Recovery = 18" No hydrocarbon odor
35			LEAN CLAY, dark brown, slightly moist, to stiff, 75% clay with low plasticity, 25% silt, mottled and micaceous. Contains minor amounts of fine to coarse, subangular gravel.	CL	Time = 1101 PID = 6.1 units No hydrocarbon odor
40		19 27 30	CLAYEY SAND, brown, moist, medium dense, 25% clay with low plasticity, 20% silt, 55% fine sand. Contains minor amounts of medium, subangular sand.	SC	Time = 1106 PID = 3.8 units Recovery = 18" No hydrocarbon odor
45			BOTTOM OF HOLE Groundwater not encountered		

METHOD OF DRILLING	<u>Hollow stem auger</u>	WELL DIAMETER	<u>NA</u>
HOLE DIAMETER	<u>8.0 inches</u>	WELL MATERIAL	<u>NA</u>
COMPLETION DEPTH	<u>40 feet</u>	WELL DEVELOPMENT	<u>NA</u>



BORING NUMBER SB-3 CLIENT UNOCAL Marketing and Refining
 DATE DRILLED 3/5/93 PROJECT Service Station #4357
 INCLINATION 25° GEOLOGIST Manuel Saenz

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
			4" of asphalt		Time = 1300 PID = 0.0 units
			LEAN CLAY, dark brown, slightly moist, stiff, 85% clay with low plasticity, 15% silt., slightly mottled.	CL	Time = 1310 PID = 0.0 units No hydrocarbon odor Airknife down to 5' bgl.
5.0			LEAN CLAY, dark brown, slightly moist, stiff, 85% clay with low plasticity, 15% silt., slightly mottled.	CL	
10			LEAN CLAY, dark brown, slightly moist, stiff, 85% clay with low plasticity, 15% silt., slightly mottled.	CL	Time = 1315 PID = 3.2 units No hydrocarbon odor
15		9 12 15	LEAN CLAY, dark brown, slightly moist, stiff, 85% clay with low plasticity, 15% silt., slightly mottled. Contains minor amounts of fine sand.	CL	Time = 1329 PID = 2.6 units Recovery = 18" No hydrocarbon odor
20			LEAN CLAY, dark brown, slightly moist, stiff, 85% clay with low plasticity, 15% silt., slightly mottled. Contains minor amounts of fine sand.	CL	Time = 1335 PID = 4.2 units No hydrocarbon odor
25			LEAN CLAY, dark brown, slightly moist, stiff, 85% clay with low plasticity, 15% silt, 5% fine sand, slightly mottled.	CL	Time = 1342 PID = 4.2 units No hydrocarbon odor

METHOD OF DRILLING	<u>Hollow stem auger</u>	WELL DIAMETER	<u>NA</u>
HOLE DIAMETER	<u>8.0 inches</u>	WELL MATERIAL	<u>NA</u>
COMPLETION DEPTH	<u>50 feet</u>	WELL DEVELOPMENT	<u>NA</u>



BORING NUMBER	<u>SB-3</u>	CLIENT	<u>UNOCAL Marketing and Refining</u>
DATE DRILLED	<u>3/5/93</u>	PROJECT	<u>Service Station #4357</u>
INCLINATION	<u>25°</u>	GEOLOGIST	<u>Manuel Saenz</u>

Depth in Feet	Sampling Interval	Blow Counts	DESCRIPTION	USCS SYMBOL	REMARKS
			LEAN CLAY, dark brown, slightly moist, stiff, 85% clay with low plasticity, 15% silt, 5% fine sand, slightly mottled.	CL	Time = 1342 PID = 4.2 units No hydrocarbon odor
30		17	LEAN CLAY, dark brown, slightly moist, stiff, 85% clay with low plasticity, 15% silt, 5% fine sand, slightly mottled. Contains minor amounts of gray-black discoloration.	CL	Time = 1348 PID = 3.0 units Recovery = 16" No hydrocarbon odor
		19			
		28			
35			LEAN CLAY, dark brown, slightly moist, stiff, 85% clay with low plasticity, 15% silt, 5% fine sand, slightly mottled. Contains minor amounts of gray-black discoloration.	CL	
40		20	LEAN CLAY, dark brown, slightly moist, stiff, 85% clay with low plasticity, 15% silt, 5% fine sand, slightly mottled. Contains minor amounts of gray-black discoloration.	CL	Time = 1355 PID = 2.0 units Recovery = 18" No hydrocarbon odor
		27			
		31			
45			LEAN CLAY, dark brown, slightly moist, stiff, 85% clay with low plasticity, 15% silt, 5% fine sand, slightly mottled. Contains minor amounts of gray-black discoloration.	CL	Time = 1401 PID = 2.2 units No hydrocarbon odor
50		21	LEAN CLAY, dark brown, slightly moist, stiff, 85% clay with low plasticity, 15% silt, 5% fine sand, slightly mottled. Contains minor amounts of gray-black discoloration.	CL	Time = 1406 PID = 2.0 units Recovery = 18" No hydrocarbon odor
		22			
		28			
			BOTTOM OF HOLE		
			Groundwater not encountered		

METHOD OF DRILLING	<u>Hollow stem auger</u>	WELL DIAMETER	<u>NA</u>
HOLE DIAMETER	<u>8.0 inches</u>	WELL MATERIAL	<u>NA</u>
COMPLETION DEPTH	<u>50 feet</u>	WELL DEVELOPMENT	<u>NA</u>

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APPENDIX C

General Field Procedures

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GENERAL FIELD PROCEDURES

A description of the general field procedures used during site investigation and monitoring activities is presented below. For an overview of protocol, refer to the appropriate section(s).

DRILLING AND SOIL SAMPLING

Soil borings are drilled using continuous-flight, hollow-stem augers. Borings that are not completed as monitoring wells are grouted to within 5 feet of the ground surface with a cement/bentonite slurry. The remaining 5 feet is filled with concrete.

Soil samples are obtained for soil description, field hydrocarbon vapor screening, and possible laboratory analysis. Soil samples are retrieved from the borings by one of two methods: 1) continuously, using a 5-foot-long, continuous-core barrel sampler advanced into the soil with the lead auger (sample tubes are placed in the core barrel or driven into the core with a mallet), or 2) at 2.5- or 5-foot intervals, using a standard split-spoon sampler lined with four 1.5-inch-diameter stainless steel or brass sample inserts. The split-spoon sampler is driven approximately 18 inches beyond the lead auger with a 140-pound hammer dropped from a height of 30 inches.

For hand auger borings and hand-held, power-driven auger borings, soil samples are retrieved using a hand-driven slide hammer lined with a 1.5-inch-diameter stainless steel sample tube.

During drilling activities, soil adjacent to the laboratory sample is screened for combustible vapors using a combustible gas indicator (CGI) or equivalent field instrument. For each hydrocarbon vapor screening event, a 6-inch-long by 2.5-inch-diameter sample insert is filled approximately 1/3 full with the soil sample, capped at both ends, and shaken. The probe is then inserted through a small opening in the cap, and a reading is taken after approximately 15 seconds and recorded on the boring log. The remaining soil recovered is removed from the sample insert or sampler, and described in accordance with the Unified Soil Classification System. For each sampling interval, field estimates of soil type, density/consistency, moisture, color, and grading are recorded on the boring logs.

SOIL SAMPLE HANDLING

Soil sample handling follows the same basic protocol for both drilling and excavation activities. Upon retrieval, soil samples are immediately removed from the sampler, sealed with Teflon sheeting and polyurethane caps, and wrapped with tape. Each sample is labeled with the project number, boring/well number, sample depth, geologist's initials, and date of collection. After the samples have been labeled and documented in the chain of custody record, they are placed in a cooler with ice at

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approximately 4 degrees Celsius (°C) prior to and during transport to a state-certified laboratory for analysis. Samples not selected for immediate analysis may be transported in a cooler with ice and archived in a frostless refrigerator at approximately 4°C for possible future testing.

DECONTAMINATION

Drilling and Soil Sampling

Drilling equipment is decontaminated by steam cleaning before being brought onsite. The augers are also steam cleaned before each new boring is commenced. Prior to use, the sampler and sampling tubes are brush-scrubbed in a Liqui-nox and potable water solution and rinsed twice in clean potable water. Sampling equipment and tubes are also decontaminated before each sample is collected to avoid cross-contamination between borings.

ANALYTICAL METHODS, OFFICIAL LABORATORY AND QUALITY ASSURANCE / QUALITY CONTROL REPORTS, AND CHAIN OF CUSTODY RECORDS

Analytical Methods

All analyses were performed by a state-certified laboratory in accordance with the United States Environmental Protection Agency and the Los Angeles Regional Water Quality Control Board, Methyl Tertiary Butyl Ether Pollution Investigation of the Charnock Sub-Basin -- Information Request and Model Site Specific Work Plan for Assessment of Potential Responsible Party sites (File Number 96-042), June 19, 1990.

Official Laboratory Reports and QA/QC Reports

Official laboratory and QA/QC reports are provided by the state-certified laboratory performing the analysis. The QA/QC reports for samples from each group of analysis completed for a single gas chromatograph calibration are provided.

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Chain of Custody Protocol

Chain of Custody protocol was followed for all samples selected for laboratory analysis. The Chain of Custody form(s) accompanies the samples from the sampling locality to the laboratory, providing a continuous record of possession prior to analysis

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APPENDIX D

Site Health and Safety Plan

SITE HEALTH AND SAFETY PLAN

Site Assessment
Unocal 76 (Tosco) 4357 Station
Los Angeles, California

1.0 PLAN SUMMARY

This Site Health and Safety Plan (SHSP) establishes responsibilities, requirements, and procedures for the protection of personnel while performing activities at the above-referenced site. This site-specific plan conforms with the Alton Geoscience Corporate Health and Safety Plan, Hazard Communication Program, and Injury and Illness Prevention Program (IIPP).

During site work, the use of proper health and safety procedures, in accordance with applicable Cal/OSHA regulations shall be required. Site-specific conditions may necessitate modification of the SHSP; however, except in emergency situations no deviations from the plan may be implemented without the prior notification and approval of the Site Safety Officer (SSO).

2.0 SITE INFORMATION

This SHSP considers the physical, chemical, and environmental hazards that may be encountered during work activities at the site. Operations associated with this SHSP will be conducted in accordance with an approved workplan. Any changes required or made to the planned activities will be immediately communicated to site personnel by the SSO. Summary information for this project is provided in the following table.

Principal activities:	Site Assessment
Site description (see Attachment A for site map):	Active gasoline service station
Approximate depth to groundwater:	Greater than 95 feet below grade
Contaminants of concern (see Attachment B):	Hydrocarbons in soil

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3.0 SITE SAFETY AUTHORITY

Contact information and names of authorized personnel are listed below. A description of responsibilities follows.

Role	Name	Company	Telephone
Site Safety Officer	Bob Sturtevant	Alton Geoscience	(714) 753-0101
Alternate Site Safety Officer	Mike Pitta	Alton Geoscience	(714) 753-0101
Project Manager	Gil Fry, RG	Alton Geoscience	(714) 753-0101
Supervisor/Offsite Coordinator	Gil Fry, RG	Alton Geoscience	(714) 753-0101
Local IIPP Coordinator	Todd Stanford, REA, REHS,	Alton Geoscience	(714) 753-0101
Client Contact	Jim Adams	Tosco	(714) 428-6488

Site Safety Officer: The SSO is responsible for briefing site personnel on potential physical and chemical hazards prior to work start-up, during operations, and whenever other health and safety matters need to be addressed. The SSO will be in charge of conducting the daily Tailgate Safety Meetings. The SSO will see that this SHSP is available onsite and is understood and signed by personnel entering the site. The SSO is also responsible for implementing emergency response procedures when necessary. In the event the SSO is unable to perform these duties, the Alternate SSO will be responsible.

Project Manager: The Project Manager (PM), in coordination with the SSO, is responsible for implementing health and safety requirements, including seeing that the SHSP is prepared and available onsite. The PM is the central point of contact for the SSO, Client, and Field Personnel, and has overall responsibility for site operations.

Field Personnel: Field Personnel are responsible for understanding and complying with this SHSP. Field Personnel include both Alton employees and Subcontractors hired by Alton Geoscience. Field Personnel are required to participate in briefings prior to commencement of site work; attend daily Tailgate Safety Meetings; and acknowledge receipt and understanding of the SHSP by signing the Compliance Log at the end of this plan.

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Supervisor/Offsite Coordinator: The Supervisor/Offsite Coordinator, typically the Alton branch manager, should be contacted when mobilization of support from an Alton office is needed, and in case of an emergency requiring offsite assistance.

4.0 SITE CONTROL

Site control requires the establishment of a regulated area with designated work zones, evacuation protocol, location of medical assistance, site security, and communication guidelines that include a "Buddy System."

4.1 REGULATED AREA(S)

Each site will have an established Exclusion Zone with controlled access, and a Support Zone. Supervision and strict control of access to regulated areas is necessary to protect site personnel as well as the public.

Exclusion Zone: (*a.k.a. "Hot Zone"*) This is the area where personnel may be subject to chemical or physical hazards. It is the zone of known or suspected contamination, where equipment operation and/or environmental sampling will take place. The Exclusion Zone is to be clearly identified and isolated with cones, barricades, or high visibility caution tape. Personnel working in the Exclusion Zone will at a minimum use Level D personal protective equipment as described in Section 7.0.

The outer boundary of the Exclusion Zone ("*Hot Line*") will be established by the SSO, so that sufficient area is available to conduct operations while providing a protective buffer for persons and property outside the zone.

Support Zone: (*a.k.a. "Safe Zone"*) This is the area outside the Exclusion Zone where administrative and other support functions are located. Adverse exposure to contaminants and physical hazards are unlikely in the Support Zone.

4.2 EVACUATION PROTOCOL

Evacuation protocol and routes from the site will be established by the SSO, and communicated to Field Personnel during the Tailgate Safety Meeting(s) prior to initiating work. Evacuation protocol will be implemented as needed in emergency situations. In the event of an evacuation, personnel will meet at a preestablished location and the SSO will do a "head count" to see that everyone has left the hazard area.

Emergency Response procedures are outlined in Section 12.0. Directions to the nearest medical facilities are provided in ATTACHMENT C.

4.3 SITE SECURITY

Appropriate security measures will be established in coordination with the site owner/operator and communicated to site personnel. The objective of these measures is to (1) protect the public from potential exposure to physical/chemical hazards; (2) avoid public interference with personnel and safe work practices; and (3) prevent theft or vandalism of equipment at the site.

4.4 COMMUNICATION

Communication is an important aspect of the site control program as well as the entire SHSP. Personnel should keep in mind that hazard assessment is a continuous process, and any potentially unsafe condition must be reported immediately to the SSO.

Onsite personnel will use the "Buddy System" and maintain communication or visual contact between team members during site operations. The Buddy System is used to provide assistance, monitor for chemical exposure and heat stress, and obtain emergency assistance for co-workers when necessary.

Site personnel will be familiar with the following emergency hand signals:

Hand gripping throat:	Can't breathe. Respirator problems.
Grip team member's wrist or both hands on team member's waist:	Leave site immediately, no debate!
Thumbs up:	Yes. I'm alright. I understand.
Thumbs down:	No. Negative.

5.0 HAZARD ASSESSMENT

Hazard assessment is essential for establishing hazard reduction measures. Hazard assessment will consist primarily of site inspections and monitoring. Known operational hazards (heavy equipment, overhead lines, etc.) and site characterization data (contaminant location, concentration, etc.) are also considered in the assessment. The following is a list of potential hazards associated with the activities planned for this site:

<u>Physical Hazards</u>	Heavy equipment Overhead lines and underground utilities Explosion and fire Traffic - vehicular and pedestrian Tripping, slipping, and falling Head, foot, eye, and back injuries Falling objects Sharp objects Electrical equipment Welding hazards Excavation and trenching
<u>Chemical Hazards</u>	Gasoline / benzene, toluene, ethylbenzene, xylenes (BTEX) Environmental samples, soil cuttings, decontamination water, dust (nuisance, silica)
<u>Environmental Hazards</u>	Noise exposure Weather - heat, cold, rain, fog Biological - plants, animals/insects, pathogens
<u>Confined Spaces</u>	Hazardous atmospheres (Oxygen content; flammable, explosive, or toxic gases) Engulfment potential Restricted movement; limited space for entry/exit

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Walk-through safety inspections will be conducted by the SSO daily and as conditions change. Inspection results will be communicated to the work crews during the morning Tailgate Safety Meetings and as needed.

6.0 HAZARD REDUCTION

Personnel are required to exercise reasonable caution at all times during work activities. Failure to follow safety protocols and/or continued negligence of health and safety policies will result in expulsion of a crew member from the site and may result in termination of employment. In general, the potential for hazardous situations will be reduced by the following activities:

- *Implementing engineering controls*
- *Using personal protective equipment*
- *Performing air monitoring*

Engineering Controls, corresponding to the hazard assessment for work at this site, are outlined below in **Sections 6.1 through 6.4**. Personal protective equipment (PPE) and air monitoring guidelines are outlined in **Sections 7.0 and 8.0**, respectively.

6.1 PHYSICAL HAZARDS AND CONTROLS

Heavy Equipment

The operation and use of heavy equipment presents the greatest potential for injury to personnel. To minimize these hazards, designated routes and specific traffic patterns will be established. Trucks will use spotters for backing. If personnel need to approach heavy equipment during operation, they will observe the following protocols: make eye contact with the operator, signal the operator to cease heavy equipment activity, and then approach the equipment to inform operator of intentions.

Only equipment that is in safe working order will be used. Only qualified personnel will be allowed to operate heavy equipment. Subcontractors will supply proof of qualifications to operate the equipment.

Those crew members directly involved in spotting for the operator will be the only personnel allowed within the operating radius of the heavy equipment. Other personnel will remain at a safe distance from these operations.

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Overhead Lines and Underground Utilities

When operating heavy equipment (such as cranes or drill rigs) near overhead power lines, care will be taken to ensure that the crane boom and rigging maintain a distance of *at least 10 feet* from the power lines. A USA utility mark-out is required and will be performed prior to drilling, construction, or excavation to mark/clear underground utilities. In addition, the first 5 feet of soil borings will be excavated using an air-knife or hand auger.

Explosion and Fire

Liquid petroleum products readily vaporize from standing pools or saturated soil. Ignition sources pose an explosion and fire hazard (e.g., engines, impact sparking, and heat or arc from inappropriate equipment or instrumentation). A direct-reading combustible gas indicator (CGI) will be used to evaluate the possible formation of flammable atmospheres in and around the work area. **See Section 8.0: Air Monitoring.**

Emergency services (911) are to be called immediately in case of a fire or explosion. A portable fire extinguisher will be kept onsite for use on small fires only. Only personnel trained in the proper use of fire extinguishers are authorized to use the onsite fire extinguisher.

Traffic - Vehicular and Pedestrian

Work to be conducted in the public right-of-way requires an approved traffic control plan and traffic control setup and operation. Project personnel are required to follow state and local traffic laws. Vehicles driven by company personnel will yield to bikes and pedestrians, and at railroad crossings.

Access to work areas will be limited by the SSO to essential personnel. Delineators, barriers, and/or taping will be used to cordon off the work areas, and prevent pedestrian and vehicular traffic from entering the work zones.

Tripping, Slipping, and Falling

Personnel will be reminded daily to maintain sure footing on all surfaces. Use of safety harnesses is required for personnel working *6 feet or more* above any surface that does not have handrails (includes riding on manlifts). Work surfaces of unknown or suspect integrity will be strengthened or overlaid with a work platform capable of supporting personnel and equipment working in the area. To minimize tripping hazards caused by construction and other debris, material will be

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removed daily from the work areas and stockpiled in appropriate designated storage areas. This "housekeeping" effort will be enforced by the SSO at the end of each day.

Head, Foot, Eye, and Back Injuries

Hard hats, steel toe boots, and safety glasses will be worn during site operations. To avoid back injuries, personnel will be trained in and required to use proper equipment and lifting techniques for manual material handling.

Falling Objects

Equipment and material will be lowered to the ground "slowly" using a grapple and/or skip bucket. Personnel shall not work under this equipment; nor shall personnel other than the operator ride on the equipment.

Sharp Objects

Nails, wires, saws, and cutting equipment pose potential hazards such as cuts and punctures during site work. *Only appropriate work tools are to be used.* Personnel are required to exercise caution, and should wear leather work gloves when handling or operating cutting tools, saws, and other sharp objects. A consistent housekeeping effort at the site will also help to reduce hazards from sharp objects.

Electrical Equipment

In order to prevent accidents caused by electric shock, electrical connections will be inspected on a daily basis. Equipment found to have frayed wiring or loose connections will be shut down and locked-out until a qualified electrician has effected repairs. Electrical equipment will be de-energized and tested before any electrical work is started. Equipment will be properly grounded prior to and during work.

In addition, ground fault circuit interrupters (GFCIs) will be installed whenever possible in each circuit between the power source and tool, unless the presence of a potentially explosive atmosphere precludes this procedure. In the event that generators are used to supply power, they will be equipped with GFCIs.

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Welding Hazards

Personnel who perform or observe welding operations are required to use approved welding shields or glasses. This protective equipment will be inspected prior to each use for scratches and pits that could inhibit the ability to shield harmful ultraviolet light. Personnel are required to wear protective clothing to shield their skin from the harmful ultraviolet light produced by welding operations. Personnel working near welding operations that could ignite chemical protective clothing must wear flame-retardant outer apparel (Nomex or equivalent).

Excavation and Trenching

Excavations and/or trenching *5 feet or more* in depth will incorporate a system of shoring, sloping of the ground, benching, or other means, as provided in CCR Title 8 Construction Orders, to prevent caving. Excavations/trenching will be inspected daily by a qualified person, and after every rainstorm or other hazard-increasing occurrence. Excavations less than 5 feet deep shall also be inspected for indications of potentially hazardous ground movement.

When employees are working in trenches *4 feet or more* in depth, a safe means of access/egress shall be provided and located so that no more than 25 feet of lateral travel is necessary to reach the access/egress point.

No equipment will be allowed and no materials will be piled within *2 feet* of the edge of any trench or excavation. Adequate barrier protection shall be provided to keep mobile equipment and personnel from inadvertently falling into a trench or an excavation.

No excavation work shall take place below the level of the base of an adjacent foundation, retaining wall, or other structure until (1) a qualified person has characterized the situation as one that will not create a hazard to workers; or (2) adequate safety measures have been taken for the protection of workers.

Workers shall not be permitted underneath loads handled by excavation or loading equipment. Soil excavation, handling, stockpiling, and backfilling will not be conducted under high-wind conditions. Under these conditions, the work area, excavated material, and unpaved roadways will be watered down until the surface is moist, and maintained in a moist condition to minimize dust.

6.2 CHEMICAL HAZARDS AND CONTROLS

Chemical Characteristics

Hazardous chemicals that may be encountered at this site include diesel and gasoline hydrocarbons. These chemicals are volatile, flammable, and moderately to extremely toxic when inhaled, ingested, or absorbed above certain concentrations. See **ATTACHMENT B** for specific exposure limits and basic toxicology information.

Personnel will use engineering controls and PPE (based on hazard assessment) to prevent chemical exposure.

Sample Collection

Workers who must come in direct contact with known or suspected contaminated soil or groundwater to collect samples are required to wear protective gloves and other PPE, as needed, to reduce the potential for exposure. Safety glasses will be worn to avoid potential splashing of chemicals into the eyes.

Soil Cuttings, Decontamination Water, and Dust

As with sample collection, precautions are to be followed for handling materials such as soil cuttings and cleaning/decontamination water. Exposure and potential inhalation of dust (nuisance, silica) will be minimized by wearing dust masks or other appropriate PPE/respiratory protection.

Disposition of Materials

Excavated soil will be stockpiled and covered, or stored in closed drums or roll-off bins. Purged water will be stored in closed drums or tanks. Drums, tanks, and/or roll-off bins containing soil or water will be labeled in accordance with the hazard communication standard and removed from the site in accordance with client-approved protocol.

Hygiene

Eating, smoking, and drinking is NOT ALLOWED in the work area. Site personnel will wash their hands, arms, and faces thoroughly prior to eating or drinking, and at the end of their shift. Food should never be stored where it may come into contact with, or be contaminated by, petroleum products or other toxic materials.

6.3 ENVIRONMENTAL HAZARDS AND CONTROLS

Noise Exposure

Hearing protection (ear plugs or ear muffs) will be worn when project personnel enter high-noise areas. The SSO should see that extra ear plugs are available onsite.

Heat Stress

Heat stress may be caused by the combination of ambient factors such as high air temperature, high relative humidity, and low air movement. This condition can result in heat rash, heat cramps, heat exhaustion, and/or heat stroke. It can impair worker coordination and judgement and directly impact health and safety. Heat stress is more likely when PPE is worn. Personnel are to drink plenty of water and take breaks (in shaded rest areas) as needed to help prevent heat stress. As part of the Buddy System, personnel should watch for signs and symptoms of heat stress in coworkers as well as themselves.

Cold Exposure

To guard against cold injury (frostbite and hypothermia), which is a danger when the temperature and wind-chill factor are low, employees will wear appropriate clothing, have warm shelter readily available, and maintain carefully scheduled work and rest periods.

Biological Hazards

Personnel will assess their surroundings for potential biological hazards, which may be posed by poisonous plants, insects, animals, and indigenous pathogens. Protective clothing and respiratory equipment can help reduce the chances of exposure. Thorough washing of any exposed body parts and equipment will help protect against infection from biological hazards. "*Universal Precautions*" (e.g., wearing latex gloves) must be taken any time there is potential for exposure to human blood, such as when an employee renders first aid to a coworker.

6.4 CONFINED SPACE HAZARDS

Confined space entry is NOT ANTICIPATED during the course of these operations. However, if such a situation is encountered, workers are prohibited from entering confined spaces until the company plan dealing with confined spaces has been implemented.

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 LEVEL OF PROTECTION

Personnel are required to wear PPE appropriate for the task and anticipated exposure to known contaminants. Selection of PPE will be based on hazard assessment, task performance, and air monitoring. Based on the history of this site, the initial level of protection will be Level D. At a minimum, Level D PPE will consist of the following:

- Hardhat
at all times in work area
- Boots: chemical-resistant, steel toe and shank
at all times in work area
- Safety glasses, splash goggles, or hardhat with face shield
when there is risk of hazardous substances (sampling) or flying particles (drilling, excavation, etc.) getting into eyes
- Ear plugs / hearing protection
when high-noise equipment/drill rig is in operation
- Gloves: chemical-resistant
when handling soil cuttings or soil/water samples

Site personnel also are required to *be prepared* with the following items:

- Respirators: half-face, air-purifying with appropriate cartridges
- Dust masks
- Tyvek coveralls and other suitable protective clothing
- Traffic safety vest
- Leather work gloves and back brace/lifting belt

Air monitoring information will dictate when and if a site will be upgraded to Modified Level D (Level D plus respirator).

7.2 RESPIRATOR SELECTION

For operations that require the use of a respirator, the SSO must verify that Field Personnel are medically approved to use respiratory equipment, fit tested, and trained in the proper use of air-purifying respirators. Site personnel are required have their respirator available and ready to use onsite. Only respirators that are NIOSH/MSHA approved are to be used.

Air monitoring will be performed to assess airborne contaminant levels onsite, and to evaluate suitable respiratory protection. Workers will be required to wear half-face, air-purifying respirators with organic vapor cartridges under the following circumstances, as indicated by onsite air monitoring:

- If volatile organic compound (VOC) vapors in the work area continuously exceed the threshold limit value- time-weighted average (TLV-TWA) for gasoline (300 parts per million [ppm]).
- If, at any time, VOC vapors in the work area exceed the threshold limit value - short-term exposure limit (TLV-STEL) for gasoline (500 ppm).

TLV values for gasoline are derived from American Conference of Governmental Industrial Hygienists (ACGIH) standards. Similar precautions will be taken with regard to other toxic chemicals, such as BTEX components. See **ATTACHMENT B** for additional information and regulatory exposure limits.

7.3 REASSESSMENT OF PPE

The levels of protection listed above will be upgraded (or downgraded) based on changes in activities, changes in site conditions, measurements of direct-reading instruments (compared to action levels for contaminants), or other findings. Changes in the level of protection require the approval of the SSO.

8.0 AIR MONITORING

Monitoring will be conducted as needed to characterize airborne contaminant levels. The potential hazards associated with the presence of hydrocarbons include (1) personnel exposure to chemicals, and (2) possible formation of flammable atmospheres in and around the work area.

Air sampling will be conducted in accordance with NIOSH, OSHA, or EPA methods. The SSO will check to see that air monitoring equipment brought onsite is properly calibrated prior to operation and recalibrated during the course of the day, as necessary.

8.1 PHOTOIONIZATION DETECTOR

A photoionization detector (PID) will be used for the monitoring of VOCs in the work area in accordance with the requirements outlined in Title 8 CCR 5192. Air monitoring will be conducted in the breathing zone of workers, and the data collected will be used to evaluate suitable respiratory protection against chemicals encountered. Refer to the Respirator Selection guidelines in Section 7.2 for personal protection measures. Measurements will also be obtained periodically at the top of boreholes or excavation cavities, and during any construction activities in which hydrocarbon-affected soil is encountered; however, only breathing zone measurements will be used to determine whether PPE should be used or discontinued.

8.2 COMBUSTIBLE GAS INDICATOR

A direct-reading, portable CGI that measures VOC concentrations in ppm, or as a percentage of the lower explosive limit (LEL), will be used to monitor airborne concentrations of VOCs and evaluate the possible formation of flammable atmospheres in and around the work area. Data will be used to monitor and evaluate vapor concentrations within or emanating from well bores, excavations, and contaminated soil that is stockpiled, moved, or loaded on or about the site. Measurements will be obtained periodically at the top of boreholes or excavation cavities throughout drilling or excavation operations, and during any construction activities in which hydrocarbon-affected soil is encountered. Periodic measurements also will be taken in areas that may contain an accumulation of combustible vapors.

In the event that CGI readings on the site exceed 10 percent of the LEL, work will be suspended, monitoring will be continued as needed to isolate the area of concern, and the following applicable environmental controls will be implemented:

1. Vapors from pooled petroleum product will be suppressed (if necessary) by spraying with foam, appropriate chemical suppressant, or carbon dioxide in gas form or dry ice.
2. Air movers will be used to ventilate the areas of concentration to below 10 percent LEL.

3. Contaminated soil will be covered with clean soil and/or sprayed with water or deodorizing chemicals in order to reduce vaporization of VOCs.

9.0 DECONTAMINATION

Due to the expected low levels and types of contaminants at the site, it is anticipated that personnel will not perform routine decontamination procedures when leaving the Exclusion Zone. Project activities will be initially conducted in Level D PPE. When decontamination is necessary, it will consist of the following:

- Removal of contaminated garments in an "inside out" manner at a designated decontamination station located at the step-off location where personnel routinely enter/exit the Exclusion Zone.
- Placement of contaminated garments in designated plastic bags or drums prior to disposal or transfer offsite. Labels in compliance with the hazard communication standard will be affixed to containers of contaminated debris and clothing.

10.0 PERSONNEL TRAINING

Personnel who will perform field activities shall meet the training requirements specified in the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard [29 CFR 1910.120 (e)]. Prior to commencement of work, the SSO will discuss the potential physical and chemical hazards associated with site operations, and review safe work practices with personnel. Personnel are required to acknowledge their understanding and willingness to comply with this SHSP before admission to the site by signing the Compliance Log at the end of the SHSP.

Other job-specific training required to perform tasks within this operation will be verified by the SSO. This training may include, but is not be limited to respirator fit testing, safe lifting techniques, confined spaces, hearing conservation, and proper fire fighting procedures.

11.0 MEDICAL PROGRAM

The site medical program has two main components: a baseline medical surveillance program, and emergency medical assistance procedures.

11.1 BASELINE MEDICAL SURVEILLANCE

Alton Geoscience has established a medical surveillance program to assess, monitor, and help protect the health of employees, in particular, employees who may be exposed to potentially hazardous substances during site work. Personnel will undergo medical examinations as follows:

Initial: Pre-employment / prior to any assignment involving work in a hazardous or potentially hazardous environment. The initial examination is used to establish a baseline picture of health against which future changes can be measured, and to identify any underlying illnesses or conditions that might be aggravated by chemical exposures or job activities.

Periodic: At least once every 12 months to measure changes in health status.

Upon notification: As soon as possible upon notification by an employee that they have developed signs or symptoms indicating possible overexposure to hazardous substances, or in response to an injury or exposure during an emergency situation.

Exit: At termination of employment.

11.2 EMERGENCY MEDICAL ASSISTANCE

An emergency medical assistance network will be established prior to work start-up. The nearest fire department, police, ambulance service, and hospital with an emergency room will be identified. See ATTACHMENT C for Emergency Services contact information. A vehicle shall be available onsite during work activities to transport injured personnel to the identified emergency medical facilities, if necessary. Company vehicles are to be equipped with a fire extinguisher and first aid kit.

12.0 EMERGENCY RESPONSE PLAN

The SSO will have controlling authority during an emergency. In the SSO's absence, the Alternate SSO will be in charge. See ATTACHMENT C for the name, location, and telephone number of emergency response organizations in the vicinity of the project site, and a map to the nearest hospital(s).

12.1 EMERGENCY PROCEDURES

In the event of an accident, injury, or other emergency, remember to:

Stop work and REMAIN CALM.

Move personnel to a safe location (evacuation plan).

Call 911 or notify other emergency facilities.

Address medical emergencies and apply first aid, if necessary.

Contain physical hazards.

(NOTE: Act only if hazard is minimal and you are trained to deal with the situation. Otherwise evacuate and wait for emergency services to arrive.)

Notify offsite supervisor and client, and initiate accident reporting procedures.

12.2 ACCIDENT REPORTING

In case of an accident, the SSO (or Alternate) will immediately notify the Supervisor/Offsite Coordinator at the nearest Alton office and later provide a report to the PM describing the following:

1. A description of the event (including date and time) that required notification of offsite personnel (i.e., medical facilities, fire department, police department) and the basis for that decision.
2. Date, time, and names of persons/agencies notified, and their response.
3. Details regarding personal injury and property damage, if any.
4. Resolution of incident and the corrective action involved.

All incidents and near misses are to be investigated in accordance with Alton's IIPP. The Supervisor's Report of Accident is to be completed and submitted to the Human Resources department within 24 hours following any accident or injury.

Site Health and Safety Plan
Unocal 76 (Tosco) Station 4357
July 24, 1997

**SITE HEALTH AND SAFETY PLAN
COMPLIANCE LOG**

I have reviewed this Site Health and Safety Plan and understand the contents of the plan. I hereby agree to comply with all safety requirements outlined herein.

Signature: _____
Safety Officer, Alton Geoscience.

Date: _____

Signature: _____
Safety Officer, Alton Geoscience.

Date: _____

Signature: _____
Print Name: _____

Date: _____
Company: _____

Signature: _____
Print Name: _____

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Company: _____

Site Health and Safety Plan
Unocal 76 (Tosco) Station 4357
July 24, 1997

**SITE HEALTH AND SAFETY PLAN
COMPLIANCE LOG**
(Continued)

Signature: _____
Print Name: _____

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Company: _____

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Site Health and Safety Plan
Unocal 76 (Tosco) Station 4357
July 24, 1997

ATTACHMENT A

SITE PLAN

Site Health and Safety Plan
Unocal 76 (Tosco) Station 4357
July 24, 1997

ATTACHMENT B

**OCCUPATIONAL HEALTH GUIDELINES
AND TOXICOLOGICAL INFORMATION**

Table B-1

OCCUPATIONAL HEALTH GUIDELINES AND TOXICOLOGICAL INFORMATION

Contaminant	ACGIH TLV-TWA (ppm)	NIOSH REL (ppm)	STEL (ppm)	OSHA PEL (ppm)	IDLH (ppm)	Routes of Exposure	Known or Suspected Carcinogen	Symptoms
Gasoline	300	n/a	500	n/a	n/a	Inhalation, Absorption, Ingestion, Contact	Yes	Irritation to eyes, skin, mucous membrane; dermatitis, headache, fatigue, blurred vision, dizziness, slurred speech, confusion, convulsions, aspiration
Benzene	10	0.1	1	1	500	Inhalation, Absorption, Ingestion, Contact	Yes	Irritation to eyes, skin, nose, resp system, giddiness, headache, nausea, staggered gait, fatigue, anorexia, weakness/exhaustion, dermatitis
Toluene	50	100	150	200	500	Inhalation, Absorption, Ingestion, Contact	No	Irritation to eyes, nose; fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, tears, nervousness, muscle fatigue, insomnia, dermatitis
Ethylbenzene	100	100	125	100	800	Inhalation, Ingestion, Contact	No	Irritation to eyes, skin, mucous membranes; headache, dermatitis, narcosis, coma
Xylenes (o,m,p,)	100	100	150	100	900	Inhalation, Absorption, Ingestion, Contact	No	Irritation to eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait, nausea, vomiting, abdominal pain, dermatitis

Site Health and Safety Plan
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TABLE KEY

ACGIH TLV-TWA	American Conference of Governmental Industrial Hygienists, Threshold Limit Value-Time Weighted Average
NIOSH REL	National Institute of Occupational Safety & Health, Recommended Exposure Limit
STEL	Short Term Exposure Limit (Gasoline STEL is by ACGIH; BTEX STELs are by NIOSH)
OSHA PEL	Occupational Safety and Health Administration, Permissible Exposure Limit
IDLH	Immediately Dangerous to Life and Health
ppm	parts per million
CNS	Central Nervous System
n/a	not available (i.e., no value has been established)

DEFINITIONS

Threshold Limit Value: Threshold limit values (TLVs) refer to airborne concentrations of substances and represent conditions under which it is believed nearly all workers may be repeatedly exposed, day after day, without adverse health effects.

Threshold Limit Value - Time Weighted Average: The time weighted average (TWA) is a concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect. TLV-TWAs are established by the ACGIH.

Recommended Exposure Limit: Unless otherwise noted, the recommended exposure limit (REL) is a TWA concentration for up to a 10-hour workday during a 40-hour workweek. RELs are established by NIOSH to reduce or eliminate adverse occupational health effects.

Site Health and Safety Plan

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Short Term Exposure Limit: A short term exposure limit (STEL) is defined as a 15-minute TWA exposure that should not be exceeded at any time during a workday. When compared to the REL (or TLV-TWA for ACGIH standards), the STEL allows the worker to be exposed to a higher concentration, BUT for a shorter period of time. Exposures above the REL up to the STEL should not be longer than 15 minutes and should not occur more than four times per day.

Permissible Exposure Limit: Permissible exposure limits (PELs) are TWA concentrations that must not be exceeded during any 8-hour work shift of a 40-hour workweek. PELs are established by OSHA (29 CFR 1910.1000).

Immediately Dangerous to Life and Health: Immediately dangerous to life and health (IDLH) values are established as concentrations from which a worker can escape within 30 minutes without suffering loss of life, irreversible health effects, or other deleterious effects that could prevent him/her from escaping the hazardous environment. The purpose of establishing an IDLH exposure concentration is to ensure that workers can escape from a given contaminated environment in the event of failure of respiratory protection equipment.

Site Health and Safety Plan
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ATTACHMENT C

EMERGENCY SERVICES
PHONE NUMBERS, DIRECTIONS, AND LOCAL AREA MAP

Site Health and Safety Plan
Unocal 76 (Tosco) Station 4357
July 24, 1997

EMERGENCY SERVICES

FACILITY / LOCATION

TELEPHONE

Emergency Situation911

Brotman Medical Center (310) 836-7000
3828 Delmas Ter
Culver City, California 90231

Fire Department
City of Los Angeles Fire Department (310) 548-7542
550 Samson Way
San Pedro, California 90731

Police Department
City of Los Angeles Police Department (310) 548-7605
2175 John S. Gibson Boulevard
San Pedro, California 90731

Poison Control Center
California Poison Control System - San Diego Division (800) 877-4766
University of San Diego Medical Center
200 W. Arbor Drive
San Diego, California 92103-8925

Office of Emergency Services (800) 852-7550

USA Dig Alert of Southern California (800) 422-4133

Site Health and Safety Plan
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LOCAL AREA MAP
with routes to hospital

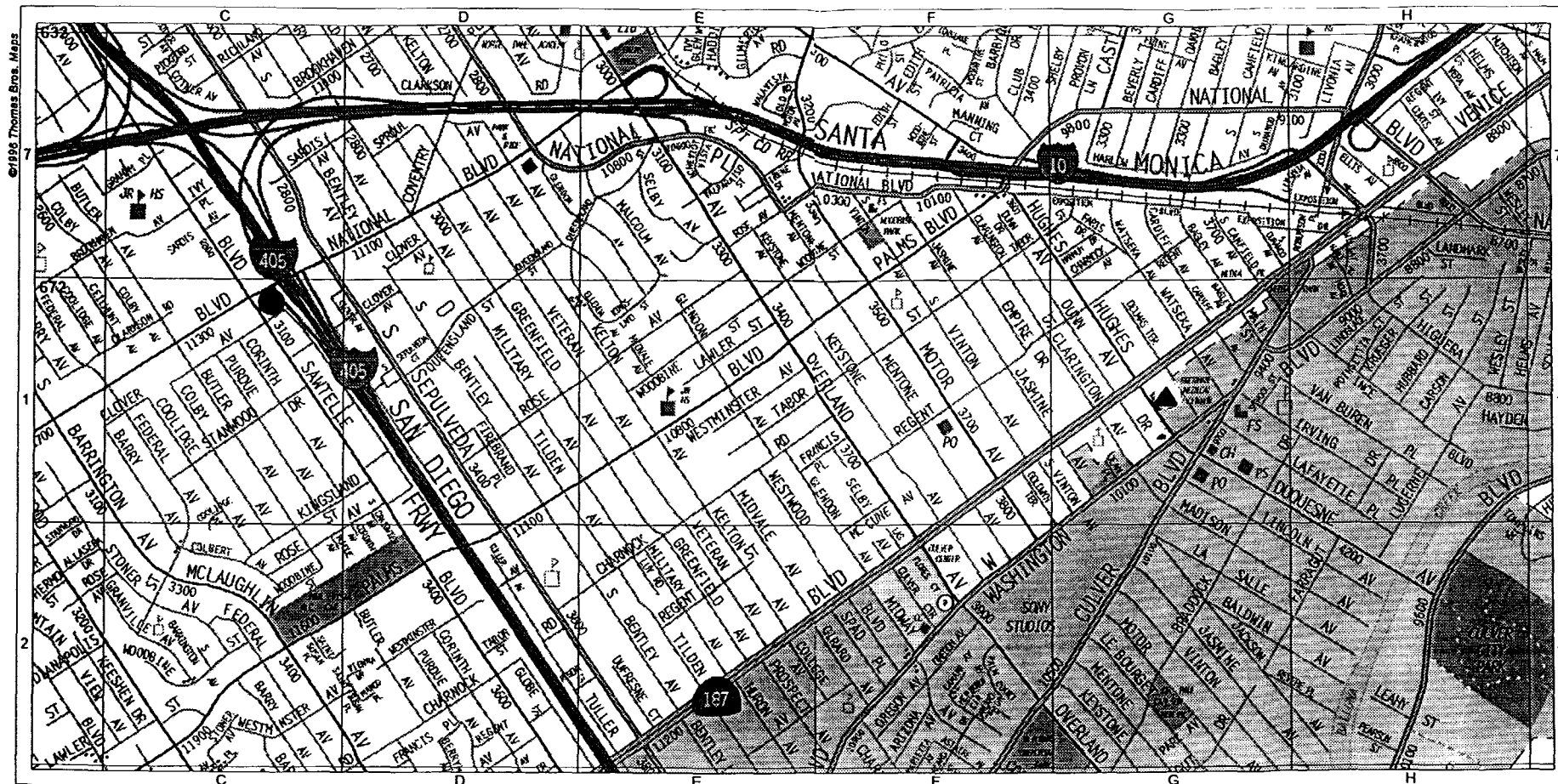
Site Health and Safety Plan
Unocal 76 (Tosco) Station 4357
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TAILGATE SAFETY MEETING CHECKLIST

Topics Covered

(Check off as discussed)

- _____ **Personnel training/qualifications:** Check cards for OSHA HAZWOPER 40-hour certification/8-hour-refresher training (other if appropriate).
- _____ **Supplies:** Indicate location of first aid kit, fire extinguisher, clean water supply (drinking, eye wash), and Site Health and Safety Plan (SHSP).
- _____ **Emergency services:** Discuss location of nearest telephone and directions to hospital. Map, directions, phone numbers provided at end of SHSP (Attachment C).
- _____ **Site background:** Discuss types, locations, and concentrations of chemicals found onsite, presence of free product, depth to groundwater, etc.
- _____ **Work activities:** Discuss scope of work for the day and activities to be performed.
- _____ **Potential hazards:** Discuss physical hazards (lifting, pinch points, traffic, working around machinery, etc.); chemical hazards (exposure limits, symptoms, air monitoring); and environmental hazards (heat stress, etc.).
- _____ **Air monitoring:** Necessary equipment is onsite and calibrated. Circle: CGI PID
- _____ **Personal protective equipment (PPE):** Discuss required level of protection. See that workers have appropriate PPE onsite; includes, but is not limited to, hardhat, steel-toe boots, safety glasses, ear plugs / hearing protection, respirator (with cartridges), gloves, traffic safety vest (other _____).
- _____ **Utilities:** Utilities have been cleared/marked by appropriate divisions.
- _____ **Traffic control (vehicular and pedestrian):** Work area is properly delineated and cordoned off from traffic.
- _____ **Compliance log:** SHSP has been reviewed and signed by site personnel.



● 76 (Tosco) Station 4357 ▲ Brotman Medical Center

